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WILDLIFE IN NORTH CAROLINA

JANUARY 1999 $1.50

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

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BIENNIAL REPORT ◆ July 1, 1996–June 30, 1998

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North Carolina Wildlife Resources Commission

512 N. Salisbury Street, Raleigh, North Carolina 27604-1188

His Excellency, The Governor of North Carolina
Members of the General Assembly
Raleigh, North Carolina

Dear Sirs:

I am pleased to present to you the 24th Biennial Report of the North Carolina Wildlife Resources Commission. This report reflects the Commission's activities and accomplishments for the period beginning July 1, 1996, and ending June 30, 1998.

As chairman of the Wildlife Commission, I am pleased to report that during the biennium, the Wildlife Endowment Fund reached a balance of nearly $36,408,000, which includes over $25.2 million in principal. The Fund is supported entirely through the sales of lifetime license and lifetime magazine subscriptions and contributions. Only the interest can be spent to support the agency's many programs.

Among the highlights of the last two years was the introduction of the computerized Customer Support System which shows great potential in making the Wildlife Commission more efficient. Land acquisition for the state's game lands has also been a major priority for the Wildlife Commission during the biennium. Several major land purchases have added more than 30,000 acres to the game land program.

One of the biggest success stories of the past two years was the recovery of the striped bass population in the Roanoke River. Last spring, anglers were allowed to take 62,700 pounds of stripers, and biologists are optimistic that the allocation can be increased for the 1999 spring season. Wild turkey populations have also risen dramatically and biologists believe that a turkey season can be held in each of the state's 100 counties within a few years.

The first two Becoming an Outdoors Woman programs were initiated during the biennium, with workshops held at Western Carolina University in Cullowhee in 1997 and at Camp Caraway near Asheboro in 1998. In October 1998, the new Pisgah Center for Wildlife Education, near Brevard, was dedicated with a monument in memory of the 10 Commission employees who gave their lives in service to conservation and the state.

The North Carolina Wildlife Resources Commission appreciates the support of the governor and legislature during this period, as well as the support of the state's sportsmen and concerned citizens. The 514 employees of the Commission rededicate ourselves to our central mission—ensuring a sound future for wildlife and for the habitat we share with them.

Respectfully yours,

Jim Bennett, Chairman

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Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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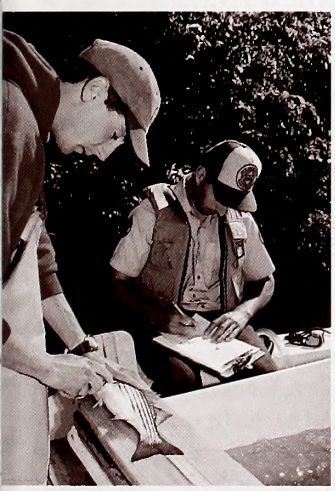

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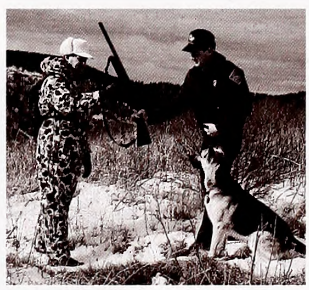

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Cover *The Wildlife Commission enters a second 50 years of conserving fish and wildlife in North Carolina.*

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Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment only by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 1-800-662-7726. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Progress for Wildlife

One word best describes the programs of the N.C. Wildlife Resources Commission during the past two years—progress.

And progress has not been limited to any one of the Commission's six divisions, but spread throughout the agency, including the new Division of Engineering Services, which is responsible for planning, constructing and maintaining boat launching areas throughout the state.

The Wildlife Resources Commission is charged with regulating and managing hunting, fishing, trapping and boating in North Carolina, and its 514 staff members range from its Raleigh headquarters staff to all 100 counties. The Commission was authorized by the General Assembly in 1947. It has been so successful that as early as the 1950s other states began modeling their agencies after the young but successful agency, proving that imitation indeed is the sincerest compliment.

Throughout its 51-year history, the Commission has been a leader. The Commission, in 1997, was the second nationally to initiate a point-of-sale computerized system to sell hunting and fishing licenses and issue boat registrations. The system makes it easier and faster for the applicant and the wildlife service agent.

The 17-member Commission sets policy as well as fishing and hunting regulations. The Commission meets six times each year, and commissioners also attend public hearings and other meetings to ensure that sportsmen's points of view are brought to the attention of the governing board.

Jim Bennett, of Greensboro, is Commission chairman. John E. Pechmann Jr., of Fayetteville, is vice chairman. Other members are C.J. Belch, of Roper; Cy W. Brame Jr., of North Wilkesboro; John T. Coley IV, of Holly Springs; Lawrence (Larry) Diedrick, of Rocky Mount; J. Robert (Bob) Gordon, of Laurinburg; Russell Maughan Hull Jr., of Elizabeth City; John F. Lentz Jr., of Ellerbe; and Joe A. Long, of Mocksville.

Also serving are Charles R. Preston, of Conover; Eugene Price, of Goldsboro; Wes Seegars, of Goldsboro; Bobby N. Setzer, of Cullowhee; W. Ray White, of Manteo; and Arthur J. Williams III, of Washington.

Charles R. Fullwood Jr. is executive director, and Richard B. (Dick) Hamilton is assistant director. The executive director is hired by the Commission, and he is responsible for hiring all other personnel. Commission employees work in six sections—Law Enforcement, Wildlife Management, Fisheries Management, Conservation Education, Administrative Services and Engineering Services.

The Commission continued to be successful in its fiscal responsibilities to citizens by posting a balance of $11,030,119 on June 30, 1998, in the Wildlife Fund—the day-to-day operating account. The Commission operated under a budget of almost $42 million for 1998. Much of the Commission's revenue is provided by the sale of fishing and hunting licenses and boat registration fees. There has been no increase in license and boat registration fees since 1987, even as the Commission has improved and expanded services for its customers—the sportsmen and other citizens of North Carolina.

And the Wildlife Endowment Fund continues to grow. The interest generated from this program, which was authorized in 1981, helps pay for Commission programs. The Endowment Fund balance on June 30, 1998, was $36,407,977, with $25.2 million of that amount being the principal balance. Interest earned since inception has amounted to more than $26.3 million. Total receipts amount to more than $51 million. The Endowment Fund is financed by the sales of lifetime hunting, fishing and combination

MELISSA McGAW

***Members of the** N.C. Wildlife Resources Commission (below) discuss staff proposals during a recent meeting. The 17-member commission meets six times a year to set policy and determine hunting and fishing regulations. From left to right are Vice Chairman John E. Pechmann Jr., Chairman Jim Bennett, Executive Director Charles R. Fullwood Jr. and administrative assistant Barb Rote.*

licenses, lifetime subscriptions to the Commission's award-winning monthly publication *Wildlife in North Carolina* and contributions.

On July 1, 1997, the computerized Customer Support System went into effect, making it easier and faster for a wildlife service agent (WSA) to issue a fishing or hunting license. Agents throughout the state are satisfied with the system. They have reported only a few problems in obtaining supplies as needed.

There were several bright spots in the Division of Wildlife Management programs during the biennium. The 47-percent increase in the harvest of wild turkey from 2,897 in 1997 to 4,250 in the spring of 1998 caused jubilation among sportsmen and staff. The increase was attributed to the opening of 38 restoration areas, good hatches and good weather during the season and to an increase in the number of hunters. The population of wild turkeys in the state is estimated at 100,000. That number should increase as more restoration areas are stocked each year. Biologists are optimistic that a turkey season can be held in each of the state's 100 counties within a few years. This spring, the Commission plans to open 62 new restoration areas to turkey hunting.

Deer populations continued to increase, and hunters reported taking 119,656 deer for the 1997 season. Bear hunters reported a harvest of 1,463 animals, indicating that the bear population continues to thrive in the mountains and coastal areas. The Commission continues to work with N.C. State University in eastern North Carolina on a nest-predator study in an effort to improve quail populations.

The Commission acquired major tracts for the game lands program in the biennium. The largest of these is the South Mountain Game Land, which adds about 18,000 acres for a total of 23,921 acres in the western Piedmont counties of Burke, Cleveland and Rutherford. The 7,900-acre Suggs Mill Pond tract was also added to the Bladen County Game Land during the biennium. These acquisitions were made possible through cooperation and financial contributions from the North Carolina Chapter of The Nature Conservancy, the Clean Water Management Trust Fund, the Natural Heritage Trust Fund, the General Assembly, the Wildlife Commission, and many individuals and private businesses.

Recovery of the striped bass population in the Roanoke River was the big success story for the Division of Inland Fisheries during the past two years. That recovery has resulted in the doubling of the spring allocation. Last spring, anglers were allowed to take 62,700 pounds of stripers from the river. Biologists are optimistic that the allocation can be increased for the 1999 spring season.

The North Carolina Angler Recognition Program (NCARP) became a reality during the biennium. Tar Heels anglers are now being recognized with citations certifying their catch of fish meeting requirements set up by the division. Species, minimum requirements and instructions for applying are found in the *Regulations Digest*.

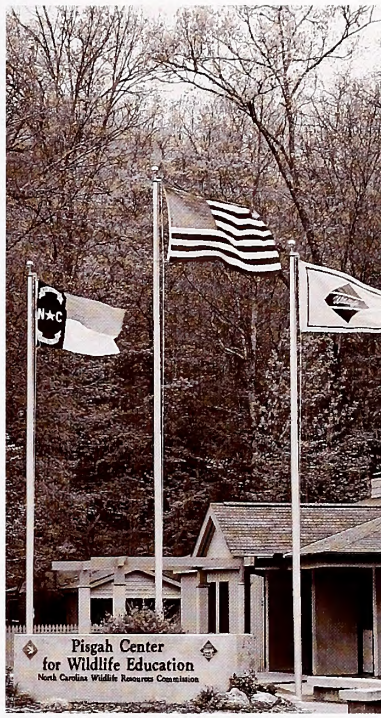
Enforcement Division staff initiated the very successful Becoming an Outdoors Woman program during the biennium, holding workshops at Western Carolina University in Cullowhee in 1997 and at Camp Caraway near Asheboro in 1998. More than 100 women attended each workshop in an effort to improve their skills in outdoor activities such as fishing, shooting, boating, archery, game preparation, outdoor cooking and other subjects.

The Enforcement Division continued to stress the importance of boating and hunting safety, including clearly marking all division boats. All officers received Global Positioning System units that enable them to determine exact locations through satellites. They also received new, improved and more comfortable personal flotation devices. In addition, two basic training schools for new wildlife enforcement officers were conducted, sending 27 new officers into the field.

A highlight of the biennium for the Conservation Education Division came in October 1998 when the new Pisgah Center for Wildlife Education, near Brevard, was dedicated. A monument in memory of the 10 Commission employees who gave their lives in service of conservation and the state was constructed at the site. The division's monthly magazine *Wildlife in North Carolina* was selected as the best state wildlife magazine in the country in 1998—the third time in five years.

The new Division of Engineering Services saw dedication of its newest boating access area in Belhaven in October 1998. The paved ramp allows launching of two boats simultaneously and has paved walkways to the floating dock, making it accessible to handicapped persons. Improvements were made to many other existing launching areas, including ramps at Wrightsville Beach and Tull's Creek.

Much progress has been made in the past two years, and commissioners and staff will be working hard in future years to make even more progress for the sportsmen of North Carolina.



KEN TAYLOR

***The N.C. Wildlife** Resources Commission dedicated the Pisgah Center for Wildlife Education during the biennium. Located in the Pisgah National Forest near Brevard, the center serves to educate the public about the Wildlife Commission's conservation programs.*

NORTH CAROLINA Wildlife RESOURCES COMMISSION

Wildlife Enforcement

During the biennium, wildlife enforcement officers continued to work hard to conserve wildlife and protect the hunting, fishing and boating public. Because wildlife law enforcement is one of the most hazardous kinds of enforcement, recruits as well as veteran officers must learn and retain special skills. That's why training is one of the most important parts of every wildlife officer's work.

◆ Training

Unlike conventional law enforcement agents, wildlife enforcement officers function in many different capacities. Our officers must not only be able to detect common wildlife violations, but also investigate complex cases. Officers conduct investigations based on information received from the public, other law enforcement agencies and wildlife agencies from other states. They gather physical evidence, submit evidence, conduct interviews and set up surveillance. In all of these, training proves to be vital.

Recruit training is one of the most important training exercises an enforcement officer must undergo. The 1998 Wildlife Enforcement Basic Training Recruit School was conducted at the North Carolina Justice Academy in Salemburg. The 16-week academy began in April with 12 recruits and graduated 11 in July. During this school, the recruits received 717 total hours of instruction covering all required law enforcement training topics, along with specific wildlife law enforcement courses. In all, 42 separate courses were taught by wildlife officers, staff instructors from the Institute of Government in Chapel Hill and staff instructors from the N.C. Justice Academy.

Other kinds of training are available as well. Supervisors at all levels receive up-to-date training twice a year. Wildlife enforcement officers continue to be certified to use the Intoxilyzer 5000. This certification allows officers to conduct a breath test to detect alcohol levels on those suspected of operating motorboats while impaired. Once officers receive their initial certification they can function as Intoxilyzer 5000 operators for two years. As a result of this training and standardized field sobriety training, wildlife officers are effectively able to detect motorboat operators who

MELISSA McGAW

***Instructor** Sgt. Gary Caulk teaches new recruits the proper use of handguns in the Enforcement Division's tough recruit school, only one of the many training courses that wildlife officers undergo. Regular training in the use of firearms, motor vehicles and boats makes officers proficient in their work.*

are impaired and endangering the lives of safe boaters.

Twice a year, officers also receive firearms training, consisting of day and night qualification courses and combat courses. The combat courses continue to expand, using realistic scenarios involving both handguns and shotguns. The Wildlife Commission is committed to providing its enforcement officers with the latest and most up-to-date training available, allowing the officers to better serve the sporting public and citizens of North Carolina.

◆ Emergency Management

Wildlife officers provide the citizens of North Carolina with a variety of services besides their primary function of enforcing the state's wildlife laws. A good example is the vital role served by officers with the state's Division of Emergency Management. Staff officers serve on the State Emergency Response Team (SERT), providing a liaison between agency resources and requests received from emergency management staff. Officers participate in various preparedness drills that include nuclear site evacuations at the Shearon Harris, McQuire, Catawba and Brunswick nuclear power stations. Wildlife officers can warn the public of a nuclear event in areas that are accessible only by boat. Division aircraft can also identify areas that need to be evacuated.

As a result of our involvement, officers receive training in radiological monitoring and are recertified every two years. SERT members are on call 24 hours a day, seven days a week and are also notified in times of disasters such as hurricanes or winter storms. At these times, wildlife officers provide security and conduct law enforcement operations in areas that are accessible only by boat or vehicles with four-wheel drive. A SERT member at the Emergency Operations Center located in Raleigh receives requests, and the information is relayed to the appropriate areas.

◆ Canine Report

Since the statewide canine program began in January 1996, its personnel and their canine partners have continued to exhibit exceptional dedication. Hard training and willingness to excel have produced excellent results.

Nine teams, each consisting of an officer and a dog, have detected numerous violations of wildlife laws, detected illegally obtained wildlife, located lost people as well as suspects in criminal cases, and assisted numerous law enforcement agencies. The versatility of these teams has been recognized by many agencies.

The Wildlife Commission's nine *canine teams, each consisting of an officer and a dog, are able to perform a variety of law enforcement tasks across the state. Wildlife Officer Danny Gibson and Max (below) check a hunter in the mountains of Haywood County.*

KEN TAYLOR

During the 1998 United States Police Canine Association, the Division of Enforcement entered six teams for certification. These certifications tested obedience, agility, article search, suspect search and criminal apprehension. All the teams received high scores, qualifying them to compete in national trials. Of the 61 canine teams from 26 law enforcement agencies from Maryland, Washington, D.C., North Carolina and South Carolina, four North Carolina wildlife canine teams were recognized as the best trained canine teams by the United States Police Canine Association.

During the biennium, North Carolina's first canine partner, Link, was retired from wildlife enforcement work. Officer Michael Criscoe acquired Link in 1986, and the team was commissioned to pilot a program for testing the use of canine units for wildlife law

Wildlife Enforcement

Wildlife *Enforcement Officer Wes Barger (right) marks the location of an illegal turkey-baiting station with a hand-held global positioning system (GPS) unit. This new technology helps officers precisely locate sites so they can revisit them later. A budding angler gets a helping hand from Officer Clint Bell at a Becoming an Outdoors Woman workshop, one of two organized by the Enforcement Division during the biennium.*

KEN TAYLOR

enforcement in North Carolina. Link was the first canine to be certified, and he proved his worthiness throughout his career, finding lost children, sniffing out poached game, finding shell casings as evidence, leading his handler directly to fishermen and hunters in isolated areas, and performing many other feats in more than 300 major wildlife cases.

Link has served his master and the N.C. Wildlife Enforcement Division faithfully for 10 years and deserves to spend the remainder of his years in the tranquility of his master's backyard.

◆ Equipment

The Enforcement Division strives to provide officers with equipment that will help us protect wildlife in an ever-changing and fast-paced world. The purchase of all-terrain vehicles, for example, has enabled officers to gain access to remote regions of the state. Specialized equipment such as deer and turkey decoys

KEN TAYLOR

has been very effective in aiding officers in detecting hunting violations. Even clothing can make a difference. During the past year, new turtleneck shirts, crewneck sweaters and rainwear have given officers extra protection from the elements.

Last winter, all wildlife officers received inflatable personal flotation devices (PFDs), which the officers now wear anytime they are working in a boat. These U.S. Coast Guard-approved PFDs are compact, and the officers can wear them comfortably even in hot weather. Many of our patrol boats over the last two years have also been equipped with more powerful radios that provide greater coverage. This is essential when the communication center has to reach an officer or in the event the officer needs assistance.

Since many wildlife violations occur at night, the Enforcement Division has purchased additional night-vision scopes and thermal-imaging units for each district across the state. The night-vision scope acts like a pair of binoculars that allows an officer to see in darkness as if it were broad daylight. The thermal-imaging unit allows the officer to see anything that gives off heat—spent shell casings, a used firearm that has been thrown from a vehicle or an animal that has been shot. The unit can even locate people in darkness.

The Enforcement Division has also provided all officers with Global Positioning System (GPS) units. These hand-held electronic devices work off of satellites and can pinpoint any place in the state within approximately 20 feet. These capabilities enable officers to walk directly to a site even if they have never been in that section of woods before. Since the GPS units are installed in Commission aircraft as well, a pilot can mark a spot from the air, and officers on the ground can easily locate it.

Sgt. John Massey ◆ *Area Sergeant, District 5*

MELISSA McGAW

My primary responsibilities as an area sergeant include supervising the wildlife law enforcement operations carried out by five wildlife officers in Alamance, Caswell and Orange counties. I also supervise the operations of a pilot who flies enforcement missions statewide. Our main goal is to enforce the game, fish and boating laws of the state.

During the fall and winter, we mainly work hunting activities. During the spring, our big push is turkey hunting and then we switch to boating and fishing law enforcement through the summer. We also conduct hunting and boating safety seminars to ensure that the public is better informed.

What I like best about my job is catching people who violate the game and fish laws. When I catch a poacher, I feel like I'm stopping someone from abusing a resource that is owned by the people of North Carolina.

The challenge to all wildlife officers is to do our best to catch someone who is reported to us by the public. Without citizens giving us tips and reporting violations, we couldn't do our jobs effectively. I feel an obligation to follow up on every tip or report I receive and to catch an outlaw reported by a landowner.

◆ Becoming an Outdoors Woman

The Enforcement Division has assumed the responsibility of developing and implementing the Becoming an Outdoors Woman (BOW) Program in North Carolina. BOW is a national program that is designed to break down the psychological and social barriers that historically have prevented women from participating in outdoor activities. The North Carolina program began in 1997. The first BOW workshop, held at Western Carolina University, was an immediate success and has since been followed by a second workshop, held at Camp Caraway, near Asheboro. Plans are under way to hold another workshop in 1999 at the North Carolina coast.

The BOW workshops have taken place over a long weekend, with participants arriving on Friday afternoon and departing Monday after lunch. One hundred women, ages 18 and up, participated in each of the first two workshops. Participants can choose from a variety of courses, including basic fishing, fly fishing, basic shotgun, rifle marksmanship, canoeing, outdoor photography and outdoor survival. Other courses offered are outdoor cooking, map and compass, stream and pond ecology, backyard wildlife, an introduction to archery and other outdoor-related courses. All of the courses are taught at an introductory level.

Private sponsorship and involvement in the BOW program come from many North Carolina conservation groups as well as national organizations, making the program a public-private venture.

◆ Hunter Education

In 1998, 14,425 hunter education students were certified in North Carolina. The number of students receiving training in advanced hunter education has been increasing. Hunter education is taught by a combination of volunteer hunter education instructors and wildlife enforcement officers. This year, an outstanding volunteer instructor has been recognized

Wildlife Enforcement

KEN TAYLOR

in each wildlife district. Instructor workshops are held in each district annually to train volunteers and to keep communication open.

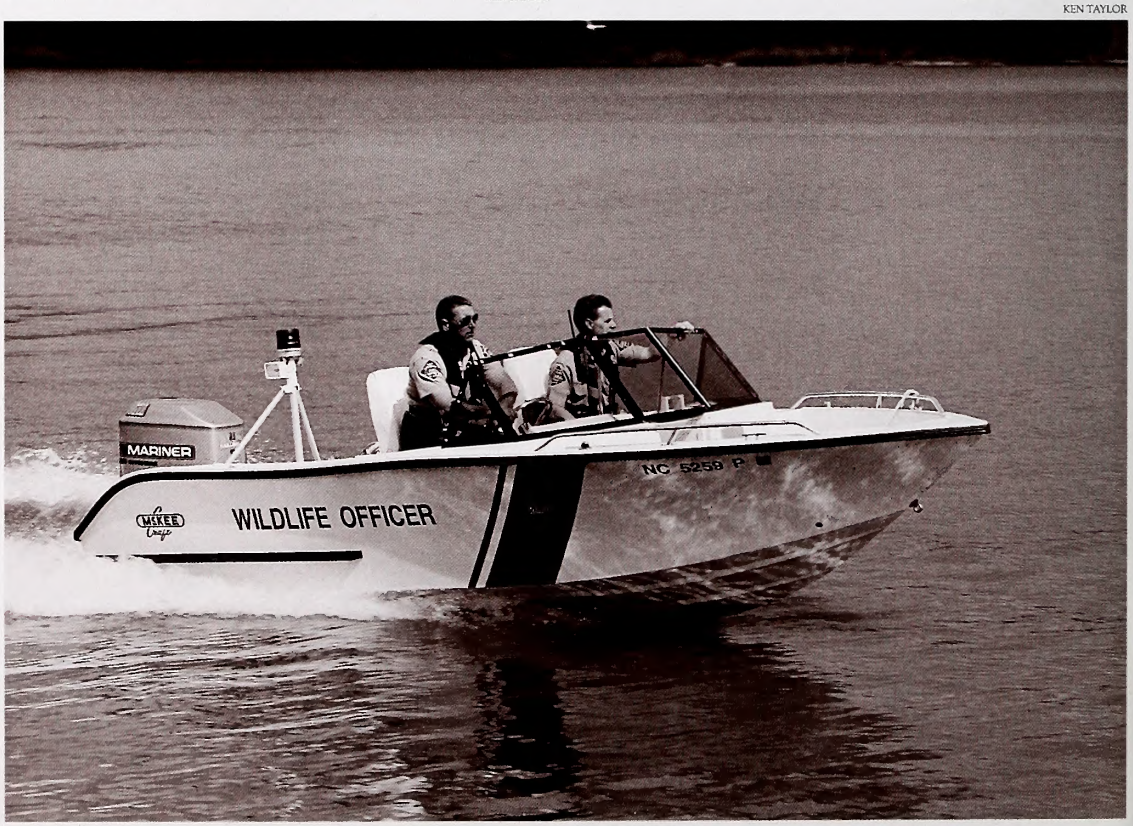
The North Carolina Hunter Education Shooting Tournament Program entered its 20th year in 1998. Hunter education shooting tournaments are held in each district. Teams that qualify go on to compete in a state tourney which has recently been held at Camp Millstone, near Ellerbe. Teams are divided into junior and senior categories. Participants compete in shotgun, small-bore rifle, archery and hunter skills. All participants must be hunter education graduates. Other youth activities planned for 1999 include an essay contest on the subject "My Personal Code of Hunting Ethics." The contest is open to hunter education graduates ages 12 to 16.

The number of hunting accidents in North Carolina remains at a historic low. Only 40 accidents occurred during the 1997-1998 hunting season, three of which were fatalities. Accidents related to tree stands continue to make up a high percentage of these numbers.

◆ Boating Education

Personal watercraft safety has been a primary focus

KEN TAYLOR



***Wildlife officers** instruct young marksmen at the 1998 youth conservation field day. Teaching hunting skills to young hunters is an increasingly important task and officers are doing their part in maintaining these traditions, especially through the Commission's hunter education program. With boat traffic increasing on the state's rivers and lakes, wildlife officers are being called upon to enforce boating laws and investigate accidents (right).*

in recent years as the popularity and use of jet skis and similar vessels has increased dramatically. Accidents tied to personal watercraft are making up an increasingly large percentage of the total boating accidents in our state. The North Carolina Boating Basics course has been modified to include a chapter on personal watercraft operation and safety. Other literature has also been added to the boating safety program in an effort to educate owners and operators of these craft.

There were 233 boating accidents in 1997, with 22 resulting in fatalities. Inattention by boat operators was the leading cause of these accidents. In the 1998 "Booze It and Lose It" campaign, the N.C. Wildlife Resources Commission joined with the Governor's Highway Safety Commission to include boating while impaired as a cause for losing one's driver's license. This partnership focused attention on the dangers of operating watercraft while impaired.

◆ Boating Patrol

Boating patrol is one of the primary functions of the Enforcement Division. With the growing number of watercraft registered in the state, the need for wildlife enforcement officers' presence on the water has increased. During the last several years, all of the new patrol boats have been marked, identifying them as wildlife officers. Boats are inspected for proper safety equipment, valid registrations and compliance to navigational rules. The recent sobriety training many of our officers have received has helped reduce the number of people operating a motorboat while impaired.

Wildlife enforcement officers are charged with the responsibility of investigating boating accidents, in addition to their other duties. Some officers have received advanced training in boat accident investigation, which includes boat accident re-creation. Investigating boat accidents can be a very complex matter because there are no skid marks, no lanes marking direction of travel and often no witnesses, and in most cases the boat or boats are no longer at the site of the accident. ⊠

Enforcement Col. Roger LeQuire *addresses more than 200 attendees at the dedication of the Pisgah Center for Wildlife Education in October 1998. The center contains a memorial to the 10 Wildlife Commission employees who gave their lives in service to the state.*

MELISSA McGAW

ENFORCEMENT SUMMARY – 1997

Activity	No. Checked	Citations	Warnings
Hunting	70,046	6,766	433
Fishing	152,675	7,635	2,900
Boating	84,622	3,501	10,170
TOTAL	**307,343**	**17,902**	**13,503**

ENFORCEMENT SUMMARY – 1998

Activity	No. Checked	Citations	Warnings
Hunting	74,515	6,660	490
Fishing	163,420	7,602	3,209
Boating	98,559	4,200	11,646
TOTAL	**336,494**	**18,462**	**15,345**

Wildlife Management

The Division of Wildlife Management had some significant changes during this biennium. Hal S. Atkinson, longtime chief of the division, retired in early 1998. Dr. David T. Cobb, a North Carolina native, left a position with the Nongame and Endangered Species Program in Florida to assume the duties of chief. We look forward to his leadership over the next biennium. The following paragraphs present a review of the past two years.

◆ Nongame and Endangered Wildlife Program

The Partners in Flight movement, a national initiative to address the conservation of migratory birds, became a major emphasis for the Nongame and Endangered Wildlife Program during the biennium. Partners in Flight has as a main goal to further bird conservation through improved communication and cooperation nationwide. Annual Partners in Flight state meetings were held, and partners throughout the state conducted nearly 50 special events in conjunction with International Migratory Bird Day to bring attention to bird conservation.

Education at all levels is an important part of this initiative. A state newsletter is distributed to a mailing list of more than 400 groups and individuals each spring and fall, and the Commission has produced a

MELISSA McGAW

MELISSA McGAW

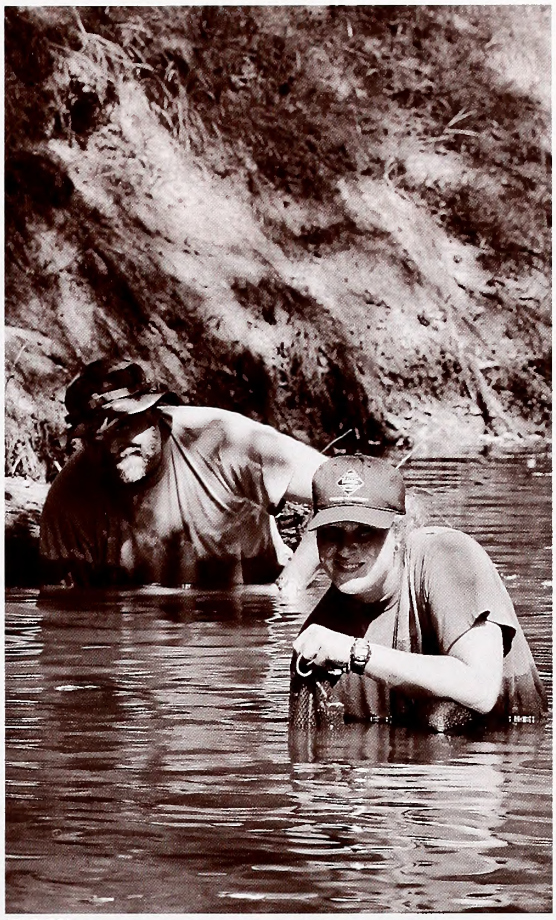
Wildlife biologist *David Allen (left) and technician Danny Ray examine and record the condition of a Kentucky warbler (above) that they trapped in a mist net before releasing it unharmed. The work is part of a national movement to conserve migratory songbirds.*

North Carolina Partners in Flight brochure. During the biennium, nongame staff gave 72 presentations to 1,614 participants on a variety of topics that included bird identification, bird-friendly coffee, backyard wildlife habitat improvement, bird migration, neotropical bird conservation and the Partners in Flight Program. In addition, 12 bird identification and monitoring technique workshops were conducted for 202 biologists, land managers and educators to improve monitoring skills and create better overall bird awareness. Nongame and Endangered Wildlife Program staff carried out Breeding Bird Survey routes and point counts statewide, and bird lists were developed for five sites. Finally, a $1.3 million proposal was developed to secure funding for a coastal birding trail in North Carolina.

Peregrine falcon restoration continued in the Mountain region during the biennium. In 1997, there were six pairs of falcons that exhibited territorial behavior at cliff sites; however, only two of those successfully raised young, for a total production of only four wild falcons. In addition to wild young produced in 1997, nongame staff members conducted a single release of five captive-bred juvenile falcons on Roan Mountain in Mitchell County.

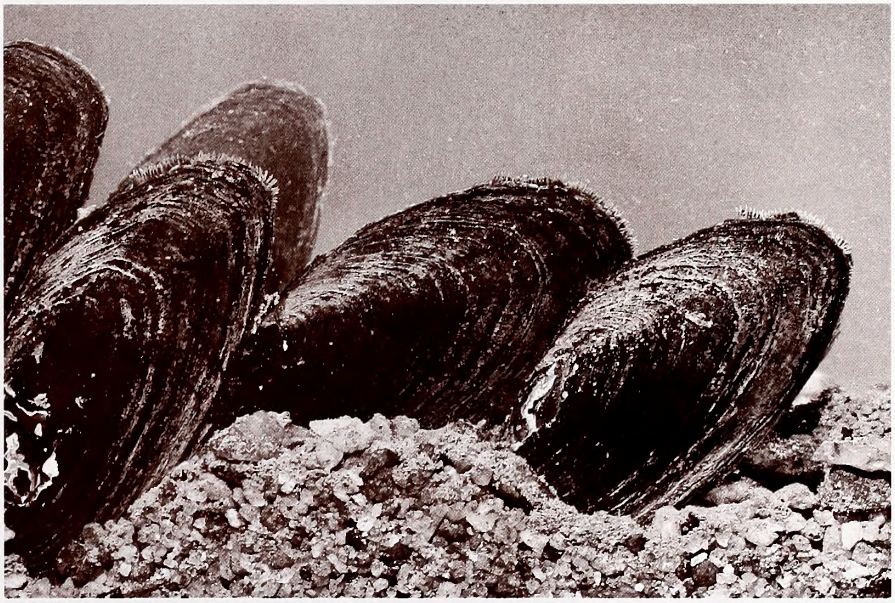
Surveys and management of colonial nesting water birds were performed during the biennium. These birds include terns, gulls, skimmers, herons, egrets, pelicans and ibises. A cooperative agreement involving other agencies and organizations has resulted in a concerted effort to protect these important resources. In 1997, biologists conducted a complete survey of all coastal estuaries and barrier island beaches. When compared with that of the past 20 years, the data obtained make it clear that several species—royal tern, common tern, least tern and little blue heron—have experienced conspicuous declines. Two common species—herring gull and great black-backed gull—have experienced population expansions, as has the brown pelican, which was previously endangered.

A research project was conducted to determine the productivity of federally threatened piping plovers on the beaches south of Cape Lookout. Beaches were surveyed to locate piping plovers during the breeding season (April through July). Once located, nests were protected with fences to keep predators away from the eggs, and signs were posted to prevent people from disturbing the incubating adults. Biologists checked nests every two to four days to determine hatching and fledging dates, monitor behavior, and detect disturbances. Information collected during this study will be used to determine what management is needed to increase piping plover productivity on our southern beaches.



KEN TAYLOR

***Nongame wildlife** biologists survey the Little River in Johnston County for endangered freshwater mussels. Some of the most endangered species on the planet, freshwater mussels such as these yellow lances (below) are threatened by water pollution and the damming of rivers.*



KEN TAYLOR

Restoration of North Carolina's rivers has become a high priority for the state during the past few years. Because of the Commission's extensive inventories of aquatic habitats associated with state parks and game lands and our statewide surveys for aquatic rare species occurrences, we provided information to numerous groups interested in river restoration projects.

Wildlife Management

Essentially, this information helped identify priority refuge areas for sensitive aquatic species. In most cases, these refuges are major tributaries or headwater areas of large rivers across the state. With leadership from numerous groups, conserving these aquatic refuge areas is in progress. Conserving the genetic stock in these refuges will allow future restoration of sensitive aquatic species to our larger rivers. The presence of such sensitive species is our best assurance of clean, healthy water for future generations.

MELISSA McGAW

Biologist *Gordon Warburton takes vital measurements from a tranquilized black bear in eastern North Carolina. Bear populations are expanding in both ends of the state thanks to careful management and protection by the Wildlife Commission.*

MELISSA McGAW

The Carolina heelsplitter is an endangered freshwater mussel with only six small populations globally. Two of these are in Union County, North Carolina. To mitigate for highway impacts to the Goose Creek population of the Carolina heelsplitter, the state Department of Transportation has funded a three-year project to protect this mussel's habitat in the creek. The goals of the project are to identify the conservation needs of this federally endangered freshwater mussel, develop plans to respond to those needs and assist in implementing voluntary conservation actions on the local level. The Wildlife Resources Commission is working with local agricultural agencies to encourage the use of conservation tillage farming, livestock waste management, livestock exclusion and the establishment of forested riparian buffers. In addition, there are plans to work with wastewater plant operators and the N.C. Division of Water Quality to develop alternatives to direct discharge of wastewater into Goose Creek.

Nongame program staff completed surveys for aquatic snails, mussels, crayfish and rare fish in the New and Linville river systems, as part of the program's three-year study of aquatic animals living in North Carolina state parks and rivers. The New River is home to three species of freshwater mussels, three species of crayfish, more than five species of aquatic snails, and three species of fish that are rare in the state. Many of the species do not appear to be faring well. One reason may be pollution of the river by sediment and other substances. There were three different species of both mussels and crayfish found in the Linville River surveys. The surveys, coupled with surveys of other state parks and rivers, will aid future planning of conservation measures for the many sensitive aquatic species of the state.

Several long-term projects that began in the previous biennium continued during this period. Among those were a cooperative Cerulean warbler distribution survey with the University of Tennessee and the U.S. Forest Service, a study of the ability of a computer model to predict northern flying squirrel distribution in the Great Balsam Mountains, and endangered freshwater mussel surveys in the Little Tennessee, Tuckasegee and Nolichucky river

KEN TAYLOR

MELISSA McGAW

***The restoration of** the wild turkey is one of the N.C. Wildlife Resources Commission's greatest success stories. Thanks to the Commission's stocking and relocation efforts, North Carolina's turkey population has increased from about 2,000 birds in 1970 to 100,000 birds this year. Wild Turkey Project Leader Mike Seamster (below left) holds a bird for banding before it is released in Moore County. Wild turkeys now occupy 99 of the state's 100 counties.*

systems. All of these projects are scheduled to be completed in the next biennium.

◆ Big Game

Big-game populations remain at high levels in response to harvest and other management activities during the biennium. With a statewide population estimated at 900,000 animals, white-tailed deer continue to be the most popular choice for hunters in the state. Hunters harvested an estimated 195,000 deer during the 1997-1998 hunting season. The biggest increases in deer numbers and harvest occurred

Wildlife Management

KEN TAYLOR

More than *35,000 acres were added to the Commission's game lands program during the biennium to provide habitat for wildlife and recreational opportunities for sportsmen. Stewardship biologist Bethany Wittkop (below) marks the boundary to a new bear sanctuary in Columbus County.*

RODNEY FOUSHEE

in the Piedmont and Mountain regions. Continued liberalization of either-sex seasons has increased doe harvests in all regions, with many counties showing some signs of stabilization of deer numbers. About two-thirds of our counties now have seasons that allow the harvest of female deer throughout the entire deer season. Nuisance reports in urban areas increased over the period, and management schemes to limit deer complaints in these settings continue to challenge our personnel.

The state's wild turkey program made significant progress during the biennium. The wild turkey population is now estimated at about 100,000 birds, occupying 99 of the state's 100 counties. Much progress was made in wild turkey restoration during the biennium. A total of 586 wild turkeys was released on 40 different restoration sites across the state. Division of Wildlife Management employees live-trapped and relocated 410 birds in-state. The division acquired an additional 176 birds from other states to supplement these efforts.

Black bear populations in both the Coastal Plain and Mountains continue to expand in both numbers and distribution. Occupied bear range increased by 74 percent from 1981 to 1991, and bears now occupy 8.8 million acres in North Carolina. Bear harvests

and bait index results in both regions have reflected these increased population trends and remained stable over the biennium.

◆ Furbearers

North Carolina coyote populations continue to increase in size and distribution due to immigration, reproduction and intentional illegal releases or escapes. Coyotes had been documented in 79 North Carolina counties at the end of the biennium, and their current distribution is probably statewide. The state has a year-round hunting season and coyotes may now be trapped during the regular trapping season established for furbearers.

This biennium marked the 11th year of the raccoon field trial survey. Raccoon hunt clubs participating in sanctioned field trial events across the state voluntarily provide data that track regional raccoon populations. Not only does this survey provide the Commission with a measure of raccoon density independent of harvest, it also provides contact and cooperation between North Carolina raccoon hunters and Commission wildlife biologists. These data should allow us to determine what impact diseases such as rabies and canine distemper virus may have on raccoon populations. It appears that, on a regional basis, raccoon populations are generally healthy and increasing or stable, in spite of local fluctuations in raccoon density caused by disease outbreaks.

During the biennium, Commission wildlife biologists cooperated with the International Association of Fish and Wildlife Agencies and North Carolina trappers to test various traps and develop best-management trapping practices. This effort is designed to obtain scientific data on the capture efficiency, selectivity and humaneness of available traps. The information will be used as guidelines for harvesting furbearers in the future.

◆ Wildlife Diseases

North Carolina is continuing to experience outbreaks of rabies in terrestrial wildlife populations. During the biennium, the N.C. Division of Health Services detected rabies in 1,319 raccoons, 147 skunks, 88 foxes, 12 bobcats, four beavers and two groundhogs from 70 counties. The number of rabies cases has begun to stabilize. Although there were cases in counties where rabies had not been present before, the number of cases detected in many counties has declined. It is not clear whether this trend indicates a shift from epidemic to endemic status in North Carolina. We can expect to have wildlife rabies with us in North Carolina from this point forward and should avoid all unnecessary contact with wild animals that exhibit abnormal behavior.

Dean Simon ◆ *Wildlife Forester*

MELISSA McGAW

As wildlife forester for the state's western region, I am responsible for coordinating forest management projects to improve wildlife habitat on state-owned game lands in the mountains. This includes timber harvests, thinning, prescribed burning and other projects. I am also responsible for developing and overseeing contracts for forest resources inventory and mapping, site preparation, tree planting and boundary line survey and marking. Another very important part of my job is to review U. S. Forest Service projects on the national forests in western North Carolina.

I enjoy seeing the results of completed forestry projects, especially those that were initiated more than a decade ago when I first became the western region forester. I truly enjoy the diversity of the mountain habitats, and take great delight in showing people areas on the game lands where we have improved habitat conditions in the mountains using prescribed fire. One of my greatest challenges is to balance our management practices to benefit both early and late successional wildlife species. Due to recent controversies over forestry practices such as clearcutting, it is also important for me to work with different groups. My goal is to dispel many of the misconceptions about forest management and wildlife.

◆ Small Game

The small-game program continues to focus on habitat improvements as we build upon relationships developed with land management agencies and farm wildlife researchers. During the biennium, we added an agricultural liaison position that is supported by shared funding with the Natural Resources Conservation Service (NRCS). The position, the primary function of which is to work with the NRCS to develop wildlife expertise within the NRCS field staff, is housed in the NRCS state office. Our Division of Wildlife Management staff continues to devote a major effort toward working with the NRCS, the N.C. Forest Service and the Cooperative Extension Service at the state and county levels to provide landowners with recommendations that combine wildlife objectives with other land management objectives.

The results of cooperative research into bobwhite quail biology and population ecology are being put

Wildlife Management

MELISSA McGAW

***Waterfowl biologist** Joe Fuller prepares to release a Canada goose in Dare County after it has been fitted with a light-weight satellite transmitter. Wildlife managers hope that satellite technology will help them better understand the migration patterns of the dwindling number of migratory geese that winter in North Carolina.*

into practice on working farms in North Carolina and Virginia. Earlier research documented a shortage of quality brood and nesting habitat on typical farmland. In cooperation with North Carolina State University and the Virginia Department of Game and Inland Fisheries, we are studying bobwhites on farms in Hyde, Tyrrell and Wilson counties in North Carolina and Amelia County, Va. We are currently in the second year of a four-year study that will evaluate bobwhite responses to habitat improvements and nest-predator removal. Additional components of the study are investigating songbirds, water quality, economics and innovative vegetation control techniques.

◆ Waterfowl

Continental duck populations continued at high levels during the biennium, following the prolonged drought that ravaged prairie breeding areas during the previous decade. Numbers of ducks wintering in North Carolina did not show similar improvement and remained below the long-term average. Relatively mild winter conditions in northern states did not help waterfowl numbers in North Carolina. Nevertheless, the number of hunters buying federal duck stamps in the state reached the highest level since 1961.

Gadwall, shoveler, blue-winged teal and green-winged teal showed the most improvement among duck species. Habitat conditions for wood duck breeding in North Carolina appeared to remain favorable. In 1997, biologists estimated the harvest at more than 97,000 birds. Improvements in overall duck numbers resulted in the option of a 60-day hunting season with

MELISSA McGAW

a six-duck daily bag limit in the Atlantic Flyway. An experimental September teal season was begun in eastern North Carolina in 1998.

Resident Canada goose numbers continued to increase during the biennium, evidenced by rising numbers of nuisance complaints, and may be approaching 100,000. The September Canada goose season is now open in 98 of 100 counties, and additional opportunities to hunt geese through Nov. 15 were added in all but the northeast corner of the state.

Winter counts of eastern population tundra swans have peaked during the last decade and have begun to decline slightly in recent years. They now appear to be trending upward again. Several mid-Atlantic states banded nearly a thousand swans each winter of the biennium in an effort to improve information available to wildlife managers.

During the biennium, we completed four Ducks Unlimited-Wildlife Commission MARSH (Matching Aid to Restore State's Habitat) projects. These included wetland enhancement projects on the Gull Rock Game Land in Hyde County, the Goose Creek Game Land in Pamlico County and the White Oak River Game Land in Onslow County.

In addition, the Commission completed the acquisition of 140 acres of marshlands on Roanoke Island in Dare County. The total cost of these four projects came to $432,382.14, and Ducks Unlimited provided $216,191.07, or 50 percent, of the project costs.

We continued the waterfowl field sanctuary program during the biennium. This program was first initiated in 1988 with the objective of increasing wintering populations of Canada geese and other waterfowl through habitat enhancement and protection from disturbance. The Commission leased six farms totaling 3,973 acres, located adjacent to major wintering areas, and planted them in corn and winter wheat. Peak waterfowl use of the sanctuaries, including Canada geese, snow geese, tundra swans and ducks, totaled 22,705 birds during the 1996-1997 winter period and 34,338 birds during the same period in 1997-1998.

During the biennium, the N.C. Partners Program was initiated. This program is a joint venture between

REGIONAL BIG-GAME HARVESTS, 1997-1998

Species	Coast	Piedmont	Mountains	State
White-tailed deer[a]	102,800	69,800	22,400	195,000
Wild Turkey[b]	504	1,535	2,211	4,250
Black Bear[b]	737	—	726	1,463
Wild Boar[b]	—	—	60	71

[a]mail survey estimate

[b]reported to wildlife cooperator agents or by telephone

WILD TURKEY RESTORATION, 1990-1998

Year	In-State Birds	NonResident Birds	Total Relocated
1990	161	92	253
1991	228	280	508
1992	185	128	313
1993	169	305	474
1994	212	237	449
1995	209	116	325
1996	193	371	564
1997	183	176	359
1998	227	0	227
TOTAL	1,767	1,705	3,472

Ducks Unlimited, the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service and the N.C. Wildlife Resources Commission. The purpose of this program is to restore wetlands on lands having been previously drained for agriculture or other uses. All of the projects involved the installation of water-control structures and the construction of dikes to manipulate water levels for the benefit of waterfowl and other wetland wildlife.

◆ Land Management

The game lands program continues to expand with the addition of several major land purchases. In the west we added an 18,000-acre tract to the South Mountains Game Land, greatly expanding the public hunting opportunities in the western Piedmont. An agreement with the N.C. Forest Service has also brought the 7,640-acre DuPont State Forest into the program. This area is located in Henderson and Transylvania counties.

In the east, we added the 7,900-acre Suggs Mill Pond tract to the Bladen County Game Land including several pre-existing waterfowl impoundments. Roan Island, a 2,700-acre swamp island near Wilmington, was also added to the Cape Fear Game Land. These additions to our program were made possible through several partnerships involving the Clean Water Trust Board, Natural Heritage Trust Board and the North Carolina Wildlife Endowment Fund. ⊠

Inland Fisheries

From the mountains to the sea, North Carolina is blessed with a rich diversity of aquatic ecosystems. The Division of Inland Fisheries is responsible for the management, development, conservation, protection, enhancement and regulation of our abundant inland fisheries and supporting ecosystems. Our mission is to manage these fisheries resources to provide diverse angling opportunities for all North Carolinians.

We are beginning to direct some of our funds to improve buildings and raceways at our five fish hatcheries scattered throughout the state. In addition, we are in the process of taking over a federal warm-water hatchery in Richmond County, the McKinney Lake Fish Hatchery. We are working closely with the N.C. Department of Transportation to restore mountain streams damaged during road construction. And we are implementing innovative programs to introduce our youth to the joys and relaxation of fishing. We continue to monitor fish populations, improve fish habitats and stock fish to maintain populations in our reservoirs and streams. We are able to work cooperatively with a diverse group of stakeholders, including other state agencies, environmental groups, utility companies and the public, to protect our valuable aquatic resources while providing quality recreational fishing opportunities. Our accomplishments for the biennium are summarized below.

◆ Habitat Conservation

The primary mission of the Habitat Conservation Program is to promote the conservation, protection and restoration of fish and wildlife habitat. To accomplish this mission, we review and comment on permit applications and environmental documents for proposed development projects. During the biennium, commercial and residential development continued at a rapid pace. As a result, we reviewed and commented

***The recovery of** the Roanoke River's striped bass population was one of the major accomplishments of the fisheries division during the biennium. Research Coordinator Pete Kornegay (below) loads stripers into a holding tank for measurement on the river.*

RODNEY FOUSHEE

on 3,963 projects across the state.

We expanded our stream restoration expertise by providing one of our biologists with extensive training in the principles of river function and restoration. This biologist will design and supervise the restoration of approximately 45,000 feet of degraded trout streams to mitigate impacts to streams from highway construction. Landowners are signing conservation easements, and stream restoration activities such as stream bank and channel repair and livestock fencing will begin this year. The goals of our stream restoration efforts are to restore fish and wildlife habitats in degraded stream corridors.

Following hurricanes Bertha and Fran in 1996, several southeastern counties received special federal funds to clear storm debris from streams. Though the work was expected to improve navigation and reduce flooding problems, we were concerned that too much woody debris would be removed. Woody debris significantly improves aquatic habitat diversity and is closely related to the quality of fishing in Coastal Plain streams. We recommend that debris not presenting a significant obstruction to stream flow or navigation be left in the channel as aquatic habitat.

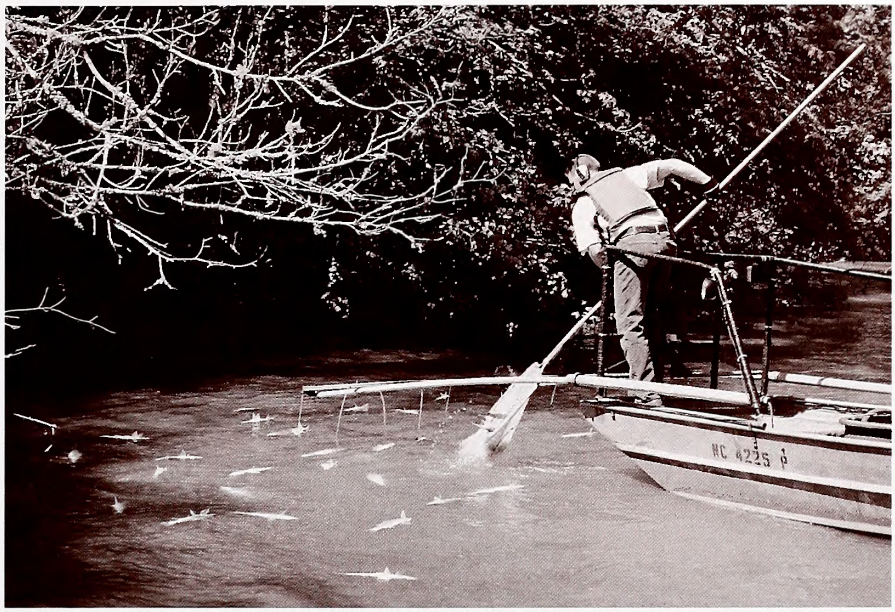
We continued to work with utility companies involved with the Federal Energy Regulatory Commission's relicensing process. On the Roanoke River, North Carolina Power is preparing an application to relicense the Gaston and Roanoke Rapids hydropower projects. The Commission and other agencies worked with North Carolina Power through the relicensing process to reduce the adverse effects of the projects on the Roanoke River ecosystem and to increase recreational opportunities on the adjacent reservoirs.

◆ Research and Survey

Coastal Region

Projects were conducted to effectively manage and enhance important freshwater recreational fisheries, including largemouth bass, crappie and sunfish, and anadromous species, such as striped bass and American shad. These and other anadromous fishes migrate into waters under the jurisdiction of the Wildlife Commission to spawn during the spring and are managed cooperatively with the N.C. Division of Marine Fisheries.

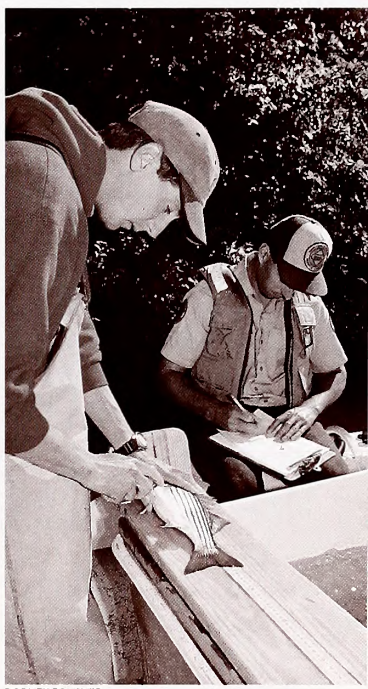
Striped bass surveys, though focusing on the major population of the Roanoke River-Albemarle Sound, have expanded to the Tar-Pamlico and Neuse rivers. District biologists sample striper, or rockfish, populations to determine age and sex composition and abundance of spawning stock during their spring migrations up coastal rivers. In 1997, the Atlantic States Marine Fisheries Commission declared the Roanoke River population recovered. These striped bass had been rebuilding for the last seven years through strict controls on recreational and commercial harvest and management of spring flows through dams on the river. Harvest quotas for recreational and commercial fisheries were subsequently increased for 1998. Sampling on the spawning grounds of the Neuse River near Goldsboro found relatively few mature females during 1997 and 1998. Striped bass fingerlings have been stocked in the Tar-Pamlico and Neuse rivers to assist the restoration of these stocks.



KEN TAYLOR

A project was initiated in 1998 to aid the recovery of American shad in the Roanoke River, through funds from the state Department of Transportation as mitigation for unauthorized construction activities. Fisheries technicians collected adult shad at night in the Meherrin and Tar rivers. Fertilized eggs were then transported to the Edenton National Fish Hatchery, where they were hatched and marked. Almost 500,000 shad fry were stocked into the Roanoke River during spring 1998.

During 1998, biologists completed a two-year study to determine if stocking largemouth bass into Currituck Sound would enhance populations. Currituck Sound was a renowned bass fishery through the 1980s, but several years of high salinity levels reduced bass reproduction and caused the population to plummet. During 1996 and 1997, approximately 13,000 bass fingerlings raised at the Commission's Watha State Fish Hatchery were marked with magnetic tags that allow identification and stocked into three embayments of Currituck Sound. A total of 52 tagged fingerlings were recaptured during the study. Recaptured fish exhibited excellent growth and contributed significantly to the numbers of small bass at some locations. Because sound-wide salinity levels in the springs of 1996 through 1998 were low enough to provide for



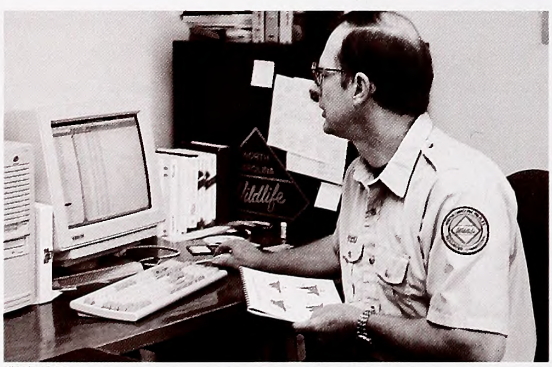
RODNEY FOUSHEE

***Fisheries biologists** use electricity to stun stripers (top) before carefully weighing and measuring them. Scale samples are also taken from each fish to help managers determine the age-class distribution of the population.*

Inland Fisheries

MELISSA McGAW

Computers *allow fisheries biologists, such as Scott Van Horn (right), to quickly compile and analyze thousands of samples in order to better understand and manage different fish populations. The result is healthier fish populations that benefit both the environment and anglers.*



KEN TAYLOR

successful spawning of native bass, biologists do not recommend additional stockings at this time.

A four-year study examining changes in redbreast sunfish populations following a reduction in creel or possession limits in the Black and Lumber rivers was completed in 1998. Fisheries biologists observed a general decrease in redbreast sunfish abundance in both rivers during the study. Oxygen depletions and resulting fish kills caused by flooding from hurricanes Fran and Bertha in 1996 and the presence of flathead catfish in the systems may have contributed to the decline in numbers of redbreast sunfish. But based on the abundance of different-sized fish found, the redbreast sunfish fisheries can be categorized as "quality" in the Black River and "exceptional" in the Lumber River.

Other surveys conducted in the coastal region include sampling largemouth bass and sunfish in Sutton Lake, a Carolina Power & Light Co. cooling reservoir near Wilmington; black crappie in the Chowan River and Lake Mattamuskeet, and largemouth bass in the Roanoke and Chowan rivers.

Coastal region biologists are completing the third year of sampling to develop methodologies for determining a qualitative index of fisheries on large streams and rivers. The index is a method for assessing fish community structure in streams and can be used to detect waters affected by pollution, other discharges or changes in water quality.

Piedmont Region

The Piedmont is dotted with reservoirs. Not surprisingly, research and survey work in the region is dominated by reservoir fisheries management issues. Largemouth bass, striped bass, crappie and their prey species—gizzard and threadfin shad—were the focus of most of the reservoir research and survey effort during the last biennium.

Biologists monitor largemouth bass, striped bass and crappie populations in our lakes, using shoreline electrofishing, gill nets and trap nets. The length, weight and age of the fish captured are determined and used to assess the health of fish populations. Fish in satisfactory populations show good growth and body weight and are present in a variety of ages and sizes. Our reservoir fisheries surveys are designed to alert managers when these conditions are not met.

Fish surveys provided managers with helpful information in recent years in the following two situations. Crappie fishing is very popular at B.E. Jordan Reservoir, and lots of crappies are removed from the lake each year. Some anglers were concerned that too many fish were being removed. Fall trap-net surveys found that individual crappies were fat and growing quickly, and there were many large, older fish in the population. Overfishing removes these large, older fish, so biologists concluded that no size limit was necessary on Jordan Lake at current fishing rates. At another location, the agency was trying to determine what might be an appropriate number of striped bass to stock in the lake. When there are too many striped bass present for the available food supply, the fish grow very slowly and become quite thin. Indeed, when gill nets on the lake revealed slow growing, thin striped bass,

RODNEY FOUSHEE

***Fisheries biologists** use various techniques including electrofishing to sample fish in lakes and streams. Biologists in the mountain region use generators carried on their backs to charge a section of the Roaring River (left) and stun fish including brown trout (below). Once they are collected and measured, the trout are released back into the river.*

biologists became cautious about stocking more fish.

The Piedmont also holds the headwaters of our major coastal rivers. Striped bass making their annual spawning run enter the region each spring. The success of the striped bass restoration effort on the Roanoke River encouraged biologists to take a closer look at the Tar and Neuse river striped bass populations. Piedmont biologists were and continue to be heavily involved in assessing a striped bass stocking program on these rivers. They are also trying to determine what steps might be necessary to restore to the rivers the older females that are so necessary for successful natural spawning.

RODNEY FOUSHEE

Mountain Region

Work in trout waters has historically dominated the research and survey programs in the mountains. Little time is left for large stream and reservoir work. This past biennium saw the completion of a two-year transition to balance cold-water and warm-water research.

In the cold-water program, trout streams managed under delayed-harvest regulations continued to be in the spotlight with anglers. Interest in these waters has continued to climb, and fishing pressure has increased dramatically since this program was initiated in 1992. The program emphasizes higher-than-average catch rates and recycling of trout through multiple captures. In October 1996, the catch-and-release period was expanded to include fall and winter months. Creel surveys conducted on four streams found anglers out on all but the worst weather days. Although catch rates appear to have declined somewhat over the years, anglers continue to be pleased with their fishing experiences.

Biologists completed an evaluation of an experimental trout regulation allowing the use of natural bait in streams classified as wild trout waters. Fish population samples on most of the 14 streams under the regulation did not show any drastic changes in the number or sizes of trout present. Creel surveys conducted on three of the streams found that about 50 percent of anglers used natural bait. Fishing pressure did not increase significantly, and the total number of trout caught and harvested by bait anglers did not appear to significantly increase total harvest or affect the overall population.

During the biennium, the division published a new trout fishing map booklet that shows the location of all Designated Public Mountain Trout Waters in North Carolina. The book guides anglers in finding public fishing waters and reduces confusion about trout fishing regulations. Each county map shows color-coded streams that correspond with existing trout regulations signs. Anglers have been pleased with these maps, and more than 3,000 have been sold.

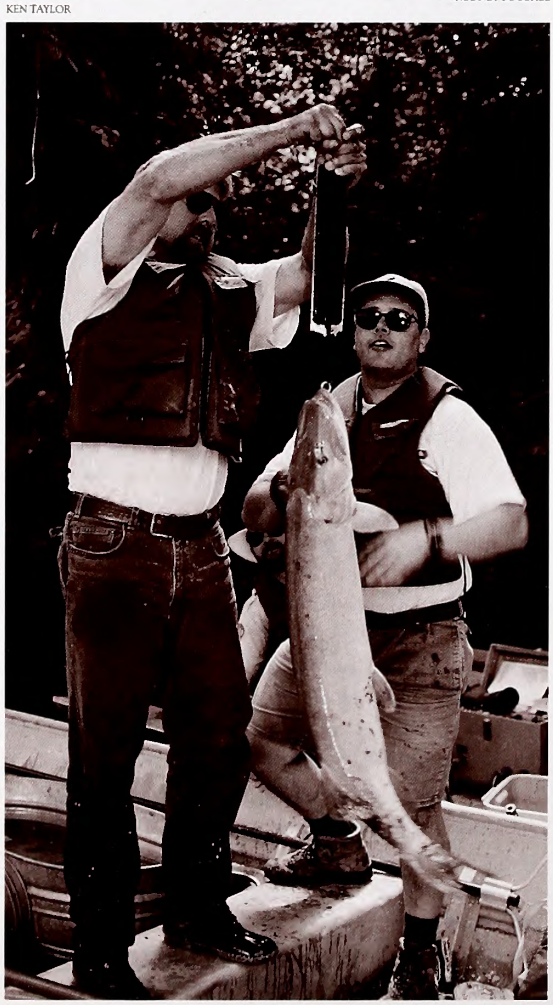
A three-year project to evaluate angler experiences on put-and-take trout streams was implemented in 1997. Creel surveys conducted on six streams determined where and when anglers were

Inland Fisheries

RODNEY FOUSHEE

The Wildlife *Commission places an emphasis on providing more access to fishing and hunting opportunities regardless of physical ability. One goal is to provide universal access to at least one trout stream under each of the Commission's six regulations within the next five years. Fishing piers and paved trails allow access to Richland Creek (above) in Waynesville. Survey work is also important, including sampling muskie (right) in the French Broad River.*

KEN TAYLOR



fishing, particularly in relation to opening day and stocking days. Except on opening day, more than 65 percent of anglers were interviewed in the afternoons, and few were out in the early morning.

Biologists developed a plan to provide physically handicapped people with more access to trout fishing waters. Our goal for the next five years is to have universal access to at least one trout stream under each of the six regulations now in effect.

Western North Carolina reservoir survey and management projects focused on three components of the sport fisheries: quality and quantity of habitat, availability of food for game fish, and harvest by anglers.

Recent management projects have improved spawning habitat and cover for black bass in several western reservoirs. In spite of the large size of many Mountain reservoirs, the amount or quality of available habitat for sport fisheries may be limited. Structures were placed in selected areas to provide cover for spawning, juvenile and adult fish.

A two-year cooperative water quality study with Western Piedmont Community College evaluated striped bass habitat on Lake Rhodhiss. The data collected will identify the amount of cool, well-oxygenated water that is available to Rhodhiss stripers during the critical late-summer months.

Surveys of shad populations in a number of mountain reservoirs showed that the availability of food organisms is a major factor that limits the growth and abundance of game fish. Because the waters and underlying soils of these systems are less fertile than those of other lakes in the Southeast, game fish in Mountain reservoirs may depend on lean and delicately balanced food chains.

To better understand the relationship between anglers and reservoir sport fisheries, creel surveys are being conducted on a number of Mountain reservoirs. Biologists will use information on angler success rates

KEN TAYLOR

and the sizes and types of fish being harvested to determine appropriate fishing regulations. Information is also being gathered on angler concerns about lake crowding and other recreational issues. A creel survey on Lake James is nearing completion and should help direct management of local fisheries, particularly black bass, walleye and crappie.

Surveys of muskie populations over the past two years in the French Broad River determined the extent of the fishery and the effectiveness of muskie stocking efforts. Muskie reproduce naturally in some areas of the river, but a significant number of the young fish in the population are hatchery raised. Sport fisheries on the New River were surveyed as part of an ongoing study of this unique resource. A creel survey is also being conducted on the New River to gain information on patterns of fishing and angler success rates.

◆ Fisheries Management

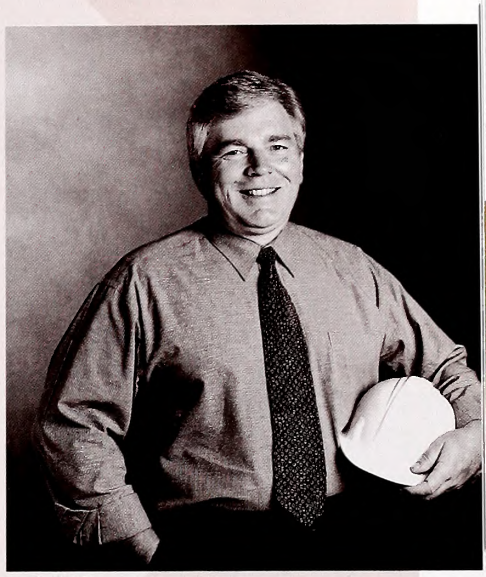
The division constructed an accessible fishing access area at Indian Camp Lake, located on the Sandhills Game Land near Hoffman. Technicians stocked the lake with largemouth bass, sunfish and channel catfish. Fish feeders were erected to provide supplemental food and to congregate fish for anglers.

Natural brush, Christmas trees and artificial PVC structures were placed to create new fish attractors or add to existing attractor sites at lakes Tillery, Norman, Falls of the Neuse, Jordan and Indian Camp. Shoreline hardwood trees were cut, hinged and cabled at Lakes Badin, Tillery and Tuckertown. New spar-type fish attractor buoys placed at 100 existing sites on Falls of the Neuse, Jordan and Norman reservoirs will develop a standardized marking system.

Cooperator participation in our Community Fishing Program increased with the addition of eight new local government parks and recreation departments. A total of 20 cooperators are now participating in this popular program, and intensive fisheries management activities are occurring at 25 ponds, lakes and streams. Three new accessible fishing piers were constructed at three Community Fishing Program sites: River Park North in Greenville, Neuseway Nature Park in Kinston and San-Lee Park in Sanford.

During the past two years, division personnel stocked more than 216,000 channel catfish at Community Fishing Program sites. Fish are usually stocked monthly (April-September) and a feeding program enhances catfish growth because of the high stocking densities. Solar-powered fish feeders dispense feed to the catfish several times daily.

Frank McBride ◆ *Habitat Conservation Program Manager*



MELISSA McGAW

As habitat conservation program manager, I supervise eight biologists working across the state. Our responsibilities include reviewing plans for development projects and other projects that involve public funds or require a state or federal permit.

Our goal is to recommend ways that each project can be completed to avoid or minimize damage to fish and wildlife habitats. We routinely recommend that mitigation be provided for unavoidable damage to sensitive habitats such as wetlands. Annually, we review and comment on approximately 2,200 projects ranging from channel dredging in Currituck Sound, to a hydropower project in the Piedmont, to road construction in Cherokee County.

Another very important part of the program is habitat restoration. We are actively involved with the restoration of degraded streams. Restoration involves returning the stream and its surrounding buffer zone to a natural state, which will provide quality fish and wildlife habitat. We have completed several small restoration projects in the mountains and are underway with a major project to improve 56,000 feet of trout streams in Madison County.

In late 1996, the U.S. Fish and Wildlife Service agreed to turn over operations of McKinney Lake Federal Fish Hatchery to the Commission. This facility is used primarily to raise channel catfish for the Community Fishing Program, with the first 100,000 fish stocked into rearing ponds in March 1997. Beginning in spring 1998, these fish were stocked into Community Fishing Program sites throughout the state.

◆ Outreach

On July 1, 1997, the division introduced a new fish citation program called the North Carolina Angler Recognition Program. Anglers catching fish large enough to qualify can apply for a certificate of recognition. More than 437 fish certificates and seven Master Angler certificates have been issued. In addition to recognizing individual angling accomplishments, the program will play a fisheries survey role. Biologists can use a summary of the applications each year to identify which reservoirs and streams are producing the most "trophy" fish, another indicator of healthy fish populations.

NCARP

NORTH CAROLINA ANGLER RECOGNITION PROGRAM

New aspects to the Community Fishing Program are the Fishing Tackle Loaner Program and instructional fish-for-fun events. Since the development of the Fishing Tackle Loaner Program in 1996, this

Inland Fisheries

KEN TAYLOR

***Fisheries technicians** cut and cable trees (above) to provide underwater habitat for various fish species. They also stock hatchery-raised fish to supplement existing populations.*

program has expanded to 22 locations statewide.

The Tackle Loaner Program provides rods and reels on loan to youngsters and adults through a process similar to checking out a book from a library. Each participant receives an identification card, and after the first loan, those under 16 years old receive a free tackle box. The Fishing Tackle Loaner Program and instructional fishing clinics at Community Fishing Program sites provide urban residents with the "how to" of fishing and the means by which to fish. This approach should cultivate angler interest and long-term participation in fishing.

CP&L donated $3,000 to purchase tackle boxes and supplies for distribution to children participating in the Commission's fish-for-fun events. Typically, the Commission holds fish-for-fun events across the state during National Fishing Week in June. During the biennium, more than 3,400 participants, mostly youths between ages 8 and 12, shared a relaxing fishing experience at 44 fish-for-fun events held across the state. These events would not be possible without the support of our many cosponsors and partners, including sportsmen's clubs, parks and recreation departments, Trout Unlimited chapters and the U.S. Forest Service. Each Forest Service district in North Carolina sponsors a fishing event annually in early June to teach children the art of fishing. However, many volunteers are now holding these events at various times throughout the year, with technical assistance from the Commission.

◆ Fish Production

Warm-Water Production

Fish production for stocking into coastal and Piedmont rivers, lakes and reservoirs occurs at the Commission's Watha State Fish Hatchery located in Pender County and at McKinney Lake Fish Hatchery in Richmond County. Warm-water species produced at these facilities include striped bass, Bodie bass, channel catfish, largemouth bass and sunfish. Technicians stock fish to enhance angling opportunities and fisheries, and to restore stocks seriously depleted by fish kills. In 1997 and 1998, fish were stocked into coastal rivers that had experienced fish kills after hurricanes Fran and Bertha in 1996. The South Carolina Department of Natural Resources assisted greatly by providing most of the sunfish stocked during 1997.

Cool-Water and Cold-Water Production

The Division of Inland Fisheries stocks approximately 600,000 catchable-size trout each year in public fishing waters across the Mountain region. Diverse fishing opportunities are made available by stocking a variety of species and sizes, including some trout weighing more than 7 pounds. Fingerling trout stocking continues to play an

KEN TAYLOR

FISH PRODUCTION PROGRAM				
Warm-Water Fishes Stocked				
Species	Size	1997	1998	Total
Striped Bass	2-6"	834,365	1,160,304	1,994,669
Bodie Bass	2-7"	91,000	75,451	166,451
Largemouth Bass	3"	109,320	28,908	138,228
Redbreast Sunfish	2"	74,800	80,000	154,800
Bluegill Sunfish	2"	169,000	104,300	273,300
Redear Sunfish	2"	100,000	54,700	154,700
Channel Catfish	4-16"	147,968	138,067	286,035
Threadfin Shad	adult	9,350	20,500	29,850
TOTAL		1,535,803	1,662,230	3,198,033

FISH PRODUCTION PROGRAM			
Cool-Water Fishes Stocked			
Species	1997	1998	Total
Walleye	430,043	530,000	960,043
Muskellunge	1,267	2,264	3,531
Smallmouth Bass	27,097	30,000	57,097
TOTAL	458,407	562,264	1,020,671

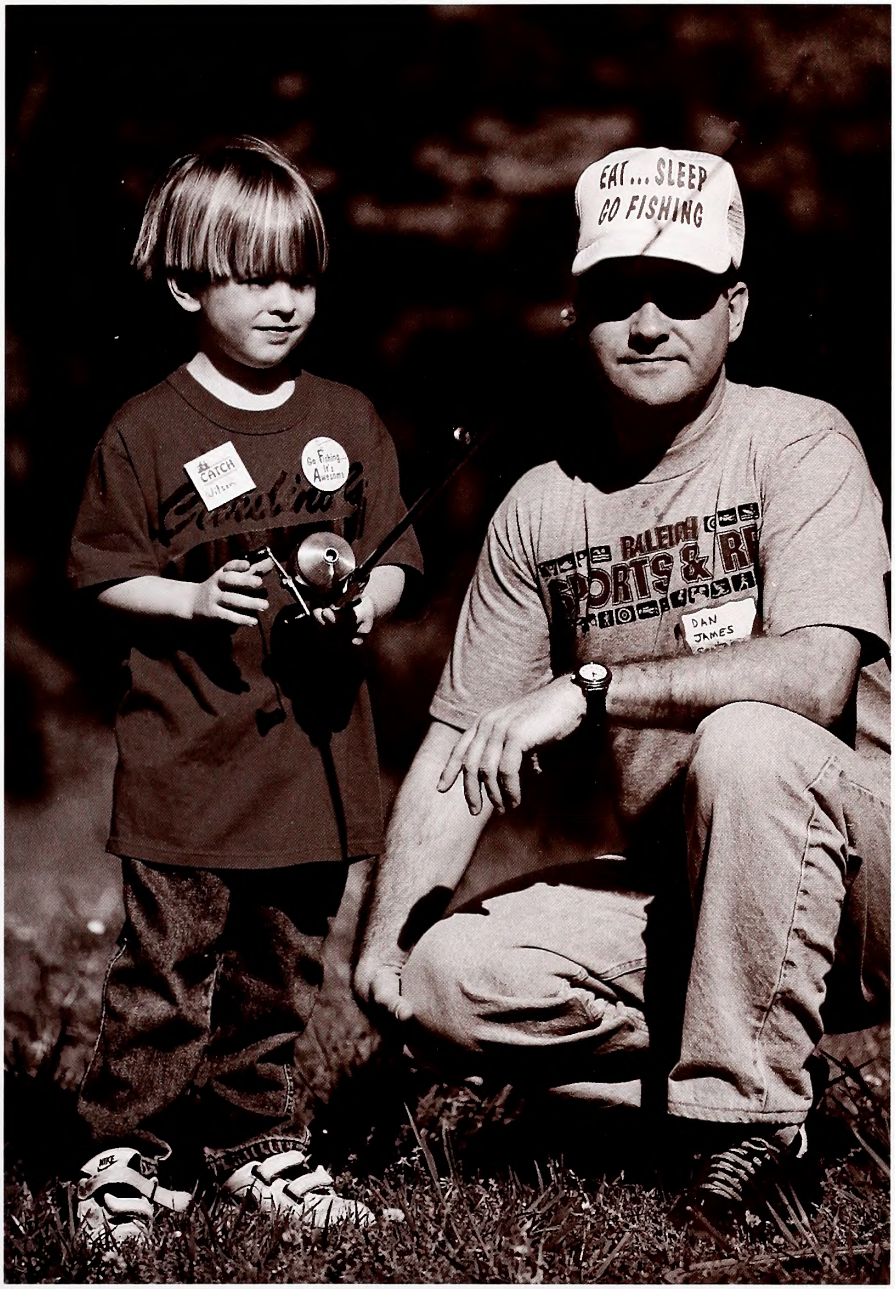
FISH PRODUCTION PROGRAM			
Cold-Water Fishes Stocked (Catchable Trout)			
Species	1997	1998	Total
Brook	230,193	244,363	474,556
Brown	131,050	114,091	245,141
Rainbow	229,847	233,657	463,504
TOTAL	591,090	592,111	1,183,201

FISH PRODUCTION PROGRAM			
Cold-Water Fishes Stocked (Fingerling Trout)			
Species	1997	1998	Total
Brook	6,259	4,012	10,271
Brown	65,052	40,031	105,083
Rainbow	14,759	22,512	37,271
TOTAL	86,070	66,555	152,625

important role in trout population management in areas having limited trout reproduction.

During the biennium, additional work was directed toward upgrading our fish production facilities. A supplemental oxygen system was installed at the Pisgah Hatchery, which has significantly increased our overall trout production. Other work included restoring deteriorating concrete raceways and limiting waste discharges to the environment through new management practices. A statewide Fish Hatchery Engineering and Planning Study was completed to direct future upgrades.

Cool-water fish species were produced and distributed from the Table Rock Hatchery. Walleye, muskie and smallmouth bass were stocked to supplement natural fish populations.



KEN TAYLOR

***Through the** division's successful Tackle Loaner Program, children and adults can borrow fishing equipment at sites across the state to enjoy the unique experience of angling.*

◆ Technical Guidance

Division fishery biologists provided free technical assistance to 331 local, state and federal agencies and corporations and 1,252 pond owners throughout the state. Pond assistance included investigating fish population dynamics, disease, fish kills and vegetation control. Ponds were reclaimed as requested, and recommendations were provided on triploid grass carp stockings, game fish stocking rates and general pond management. Pond owners were also advised about commercial hatcheries where fish could be purchased to stock their ponds. ⊠

Engineering Services

The Division of Engineering Services was established in July 1997 in an agency reorganization effort. This change was necessary due to the increased magnitude, scope and frequency of engineering-related projects within the Wildlife Commission. The primary division responsibility is to administer the Wildlife Commission's Boating Access Construction and Maintenance Program. Additionally, the division administers the Waterway Marking Program and directs, plans and manages engineering-related projects for the Wildlife Commission.

Office personnel within the division include the division chief, the program manager, two civil engineers and a secretary. The field staff is composed of eight two-person maintenance crews, one four-person construction crew and three field supervisors. Additionally, a number of temporary employees are hired during the peak boating season to assist with routine maintenance.

Field personnel are strategically located throughout the state at various work depots. Depots are located near the following cities: Camden, New Bern, Chinquapin, Fayetteville, Weldon, Troy, Marion and Waynesville. Activities completed by the field staff include routine maintenance of 175 boating access areas, participation in renovating and improving selected sites, and constructing new facilities. In addition, the maintenance crews are responsible for carrying out the Waterway Marking Program by placing and maintaining channel markers as well as informational and regulatory buoys in public waters.

◆ Maintenance of Boating Access Areas

Routine maintenance activities begin in early March and continue through October. This period coincides with the major boating activities in North Carolina. Each maintenance crew is responsible for keeping its assigned areas in a serviceable and safe condition. During the biennium, routine maintenance was completed on approximately 175 boating access areas.

Crews are responsible for trash pickup, mowing, replacing broken or damaged signs and repairing minor structural damage. Graveling and grading are completed during the early spring and during the boating season, as needed. Local storms can intensify efforts to maintain affected sites. Generally, this involves the removal of trees and limbs that have fallen on the area and the removal of sediment buildup on ramps, caused by flooding. Repairs to

__The new__ Division of Engineering Services, created during the biennium, is responsible for building, maintaining and improving boating access areas across the state. One of the busiest boating access areas on the coast, the Wrightsville Beach boat ramp (below) was renovated during the biennium. Improvements included the installation of five ramps, floating docks and a paved parking area.

KEN TAYLOR

docks are frequently needed after storms.

Five temporary employees are hired each year to assist with the increased maintenance efforts during the peak boating season.

◆ Renovation and Improvement of Boating Access Areas

Boating access renovations result in an area's being selectively repaired to return it to its original condition. This involves replacement of ramps, docks and bulkheads. It also includes reshaping and repaving parking areas and restoring drainage systems.

Boating access improvements are made to enhance and expand user services on an existing site. Types of improvements can include expanding parking areas, increasing the number of ramps and docks, improving entrance and exit roadways, paving gravel surfaces, and adding physically challenged accessibility.

This work is generally completed during the winter months, when the sites are closed. The following site improvements were completed during this biennium.

◆ New Construction of Boating Access Areas

To improve public access to state waters, division personnel construct new boating access facilities each year. It is becoming increasingly more difficult to acquire adequate sites that can be developed into boating access areas. This type of land is either not available or is too expensive to purchase. The most recent acquisitions of land have been through donations from private owners or from municipalities. Additionally, the Wildlife Commission has successfully negotiated with the state Department of Transportation for the use of selected bridge right-of-way property for development of public boat access sites.

KEN TAYLOR

Boating access improvements are made to enhance services on an existing site. Types of improvements can include expanding parking areas, increasing the number of ramps and docks, improving entrance and exit roadways, paving gravel surfaces and making sites accessible to the physically challenged.

The Commission plans, designs and constructs most of the access facilities. The following access sites were completed during the biennium.

NEW CONSTRUCTION OF BOATING ACCESS AREAS

Access Area	County	Body of Water
Sawyers Creek	Camden	Sawyers Creek
Bowsertown Road	Dare	Croatan Sound
Belhaven	Beaufort	Pantego Creek
Flemingtown	Vance	Kerr Reservoir
Cypress Hole	Pender	Northeast Cape Fear River

RENOVATIONS AND IMPROVEMENTS TO BOATING ACCESS AREAS

Access Area	County	Description
Columbia	Tyrrell	Expanded dock system, improved and replaced ramps
Wrightsville Beach	New Hanover	Installed five ramps, constructed two new stationary docks and two sets of floating docks, replaced over 1,200 feet of bulkhead, paved and striped parking area, landscape and erosion control
Murfreesboro	Hertford	Expanded dock system, improved and replaced ramp, added physically challenged access
Hibernia	Vance	Expanded, paved and striped parking area
Fifth Street Landing	Halifax	Expanded parking area, added parking curbs
Thelma	Halifax	Expanded parking, improved and replaced ramp, installed lights
Dawson Creek	Pamlico	Replaced dock
Sunset Harbor	Brunswick	Replaced docks, erosion control
West Onslow Beach	Onslow	Replaced dock
Pireway	Brunswick	Replaced concrete ramp apron
Stonehouse	Warren	Replaced docks
Summit	Halifax	Replaced docks, erosion control

Engineering Services

KEN TAYLOR

In addition to building boat ramps, the Engineering Services Division is responsible for maintaining channel markers as well as informational and regulatory buoys under the Commission's Waterway Marking Program.

◆ Cooperative Boating Access Development

Occasionally, the Wildlife Commission enters into agreements with various participants to develop access facilities. Each participant in a cooperative project has responsibilities for constructing and maintaining the project. These types of projects allow the agency to stretch the dollar and generally provide additional amenities to the project. Most cooperative projects involve development of access sites on reservoirs. Many reservoirs are managed by power companies that support and cooperate in developing recreational facilities such as public boating access areas.

During the biennium, the following projects were completed under cooperative agreements.

COOPERATIVE BOATING ACCESS DEVELOPMENT

Access Area	County	Co-op Participant
Whittenburg	Alexander	Duke Energy
Old "288"	Swain	Tennessee Valley Authority

◆ Waterway Marking

Maintenance personnel are involved in placing and maintaining channel markers as well as informational and regulatory buoys under the Commission's Waterway Marking Program. These buoys are placed in strategic locations within the state's public waters to help provide safe boating operations.

During the biennium, field staff were responsible for maintaining more than 1,200 buoys statewide. Each crew routinely inspects buoys twice a year—in March and October. This inspection consists of checking the buoy and associated hardware for damage and normal wear, cleaning the buoy and hardware and determining if each unit is properly located. Necessary repairs and replacements are made at this time in preparation for the summer or winter season.

When major storms occur, technicians occasionally move buoys off station and reposition them. The maintenance staff completes this activity. It is extremely important to make sure that each buoy

is in its proper position to ensure safe boating conditions. During the next biennium, maintenance staff will begin marking buoy stations with the Global Positioning System (GPS). This technology will enhance program effectiveness and efficiency.

◆ Other Engineering Activities

In addition to the Boating Access Construction and Maintenance Program, division staff in the Raleigh office administer the Capital Improvements Program for the agency.

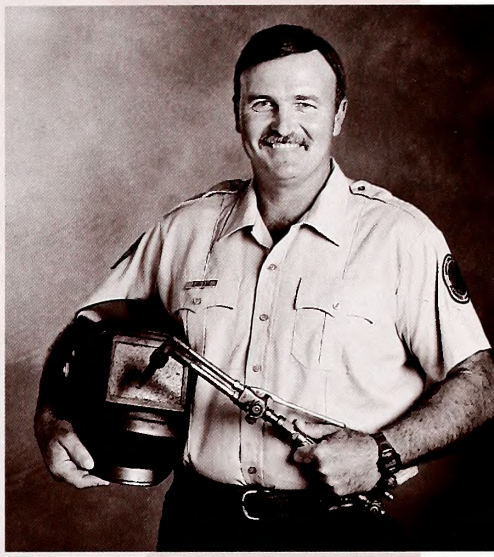
Staff members involved in this program coordinate all capital improvement projects and related matters with the Office of State Construction and represent the agency on all matters presented to the State Building Commission. The following are the key responsibilities of capital projects coordination:

- prepare project scopes and cost estimates
- participate in the selection process for all outside consultants enlisted by the agency
- monitor and track project schedules and budgets to ensure timely completion of each component
- review change orders and approve, reject, negotiate and/or make recommendations concerning their disposition; approve payments to contractors and designers; and resolve all punch list items

Additionally, the Division of Engineering Services will review and evaluate the engineering needs of each division within the agency and subsequently plan, direct and administer services to meet these needs. These services will be delegated either to in-house design staff or to outside consultants, depending upon the specific project. Subsequent construction either will be provided by in-house staff or will be contracted, depending on specific parameters. ⊠

KEN TAYLOR

Gary Dail ◆ *Boating Technician Supervisor*



MELISSA McGAW

As a boating technician supervisor, I am in charge of a construction crew that builds boat ramps, docks and parking areas. With more than 175 boating access areas across North Carolina, we stay pretty busy.

I oversee the actual construction of boating access facilities primarily in the coastal region of the state. I am also involved in the majority of the boating projects that require the use of heavy equipment.

Whether it's a new boating access area or the renovation of an existing site, each project presents unique challenges that have to be overcome. We work on many different bodies of water as well as different types of terrain. Since no two sites are the same, we constantly alter our work methods to suit the job.

Each job my crew and I undertake has a diversified work schedule that may involve heavy equipment operation, concrete work, carpentry work, as well as metal fabrication and welding. I get satisfaction from knowing that each finished access area benefits the boating public and is fully accessible to the physically handicapped.

***The Division** of Engineering Services was created in 1997 as part of an agency reorganization. Division Chief Gordon Myers reviews a boating access and design development project with engineer Shannon Patterson.*

Conservation Education

Education is a critical part of any conservation effort. The Division of Conservation Education plays an essential role in wildlife conservation through the activities of its educators, writers, photographers, designers and support staff. All of these individuals continue to focus on the main theme of the division's many endeavors —that all things are connected. Decisions about roads, community growth and similar important issues ultimately affect wildlife, and by providing accurate knowledge of natural resources, ecology and stewardship of the environment, the division hopes to influence the public's decision making.

The work of the division is divided into several different areas. Education specialists reach out to teachers, scout leaders and other educators through hands-on workshops provided by N.C. WILD and N.C. CATCH. Teachers want to learn how to better reach their students, and the workshops give them their first opportunity to test their knowledge and skills in an outdoor setting. An increase in confidence and classroom effectiveness is often the result.

KEN TAYLOR

***Educators at** a N.C. WILD workshop observe education specialist Tim Lemon as he demonstrates an activity. These outdoor activities equip many teachers to help students explore their environment while learning basic skills.*

Other division employees are working at the Wildlife Commission's new Pisgah Center for Wildlife Education. The newly opened facility offers interactive indoor and outdoor exhibits, a classroom for workshops and trout-rearing raceways that demonstrate the Commission's work and its mission to tens of thousands of visitors each year.

The division's many different publications are aimed at educating North Carolina's citizens about the interrelated and essential roles of wildlife in our natural world. The award-winning *Wildlife in North Carolina* magazine may be our flagship, but the division is increasing the number and diversity of its publications. They include *North Carolina Wildlife Calendar*, books, videos, posters and fact sheets about native North Carolina wildlife.

Here is a more in-depth look at the division's work during the last biennium.

◆ North Carolina WILD

During the biennium, the division improved the quality and quantity of its educational programs and materials. It offers a rapidly growing statewide program of educator workshops coordinated through the state's public, private and home school systems, institutions of higher learning, technical schools, youth organizations, communities and businesses. These workshops have been greatly strengthened to ensure that these materials and proper instruction reach the public, especially educators.

North Carolina WILD (N.C. WILD) continues as one of the most comprehensive and popular of the division's conservation education programs. At the heart of N.C. WILD are two interdisciplinary, supplemental educator activity guides produced by the International Project WILD program, with which this division is affiliated. Together, *Project WILD K-12 Activity Guide* and *Project WILD Aquatic Education Activity Guide* contain more than 150 hands-on wildlife and natural resource activities. Each activity describes learner objectives and methods, provides background information, identifies materials needed, outlines procedures, lists extensions and includes an evaluation. Educators, youth leaders and state agency staff can choose activities they wish to use with their audience.

For teachers in the North Carolina public school system, each activity is correlated to North Carolina's curriculum. Correlations are also available to Cub, Boy and Girl Scout advancement and project requirements. Educators and youth leaders alike have found the N.C. WILD program extremely popular with young people as they explore their environment while learning basic skills through the state's public school ABC plan and other required program goals and objectives.

To receive the activity guides and other materials, interested participants must attend the free basic 6- or 10- hour N.C. WILD Instructor Training Workshop. Workshops are facilitated by regional education specialists within the division's field branch and are offered statewide throughout the year. Teachers receive one continuing education unit (CEU) credit

for attending a 10-hour workshop. In addition, all N.C. WILD workshops are approved as part of the North Carolina Environmental Education Certification Program. To receive credit for the instructor workshop segment of this program, participants must attend the basic 10-hour workshop.

N.C. WILD content and activities emphasize the interrelated nature of wildlife, ecology, natural history and the environment. They offer an effective means to teach a variety of curricula and to provide unique opportunities for youth outreach. During the biennium, the division field staff conducted 365 WILD workshops across North Carolina, with 5,655 educators, resource agency staff and youth leaders attending.

Some N.C. WILD highlights of the biennium include the Natural Resources Regional Science Fair Award Program, the N.C. Teaching Fellows Enrichment Program, and developing partnerships for conducting Advanced WILD workshops on salamanders, endangered species, mountain stream ecology, migratory birds and bats. Adapting the program for youths with special needs has also continued.

In 1995, the division launched N.C. WILD Education Sites, a new component to the N.C. WILD program. N.C. WILD Education Sites is an opportunity for schools, businesses and community organizations to form partnerships to develop or enhance wildlife habitat. Students and adults are trained to assess habitat, solve problems and develop skills to benefit wildlife and nature. Twelve sites were begun and/or completed during the biennium. Partnerships included utility companies, industry, schools and non-profit and youth organizations.

◆ North Carolina CATCH

During the biennium, the division continued to offer its comprehensive state-based aquatic-education program known as North Carolina CATCH (N.C. CATCH). This aquatic resources program promotes the understanding of aquatic environments through hands-on learning activities, educational materials, aquatic field trips and fishing experiences.

The major components of N.C. CATCH include an instructor's guide, a student workbook, posters, fish identification cards, fish mobiles, rod-and-reel loan information and a fisheries video. These materials emphasize conservation habits, outdoor ethics, information on fish and aquatic species, water-safety tips and practical fishing skills. N.C. CATCH targets youths from ages 8 through 15. Teachers, curriculum specialists, scout leaders, park personnel, camp counselors, fishing and environmental club members, 4-H leaders and other youth leaders will find these materials adaptable and appropriate.

KEN TAYLOR

***Educational** outreach supervisor Celeste Wescott Maus works with a Jamaican teacher to teach basic fishing skills, one of the components of N.C. CATCH, the Conservation Education Division's aquatic-education program.*

To receive the free materials, interested parties must attend a 6- or 10-hour basic workshop. Workshops are facilitated by regional education specialists within the division's field branch and are offered statewide throughout the year. Teachers receive one certificate renewal unit (CRU) credit for attending a 10-hour workshop. In addition, all N.C. CATCH workshops are approved as part of the North Carolina Environmental Education Certification Program.

During the biennium, the division field staff conducted 83 workshops for 1,533 participants. The N.C. CATCH program continues to expand its outreach to accommodate educators who teach and interact with young people ages 8 to 15, including those with special needs or disadvantages. One of the N.C. CATCH highlights of the biennium was the first Advanced CATCH workshop, which was conducted in Gastonia with emphasis on primitive fish and fishing. The N.C. CATCH program was also used for winning 4-H projects and Girl Scout Silver and Gold awards. Program materials were rewritten and upgraded to broaden the use of N.C. CATCH with the N.C. Division of Marine Fisheries.

Conservation Education

KEN TAYLOR

***Education** specialist Zora Rhodes demonstrates biological information to young hunters at the 1998 youth conservation field day. The division holds several deer hunts each year for young hunters.*

KEN TAYLOR

***At one of the** many workshops at the Pisgah Center for Wildlife Education, education specialist Nina Tassin shows children how to seine a creek for aquatic life.*

◆ Youth Hunts

The division held three deer-hunting orientations and hunts to provide young hunters with opportunities and instruction on hunting safety and ethics. At the orientation the weekend before the hunt, instructors emphasized deer management, wildlife management, how to choose hunt sites, gun and tree-stand safety, outdoor ethics and orienteering using the map, compass and global positioning system (GPS). Young hunters and their guardians attended the orientation and the hunt. We continue to maintain a balance between interested male and female hunters.

The 1997 and 1998 Belews Creek Youth Deer hunts were held at the Duke Energy Belews Creek Steam Station in Stokes County. The area where the hunts were conducted consisted of approximately 800 acres of mixed pine and hardwood forests with occasional grass fields and planted power line rights-of-way. The 1998 Edgecombe County Youth Deer Hunt was hosted by private landowners on more than 500 acres of farmland with the assistance of local sportsmen.

◆ Pisgah Center for Wildlife Education

During the biennium, construction on the Pisgah Center for Wildlife Education was completed. Located in the Pisgah National Forest near Brevard, the center consists of educational exhibits in indoor and outdoor settings. Its theme, "Mountain Streams: Where Water and Life Begin," emphasizes the essential role of clean water in life processes in general and in the health of humans. The center also emphasizes the role played by the N.C. Wildlife Resources Commission in wildlife conservation.

The indoor portion of the exhibit uses interactive components to help the visitor understand North Carolina's varied ecosystems. Also part of the center's indoor space is a classroom that will host N.C. WILD workshops. Public rest rooms and a gift shop stocked with educational materials complete the impressive facility.

The outdoor portion of the facility includes a trout hatchery, where the Wildlife Commission raises rainbow trout for stocking. A half-mile walkway follows a mountain stream with learning stations that interpret the natural surroundings, mountain habitats and wildlife conservation. The outdoor exhibits also contain an example of a N.C. WILD Education Site that demonstrates how wildlife habitat can be developed and used as an educational aid.

In October 1998, the Wildlife Commission dedicated a monument at the Pisgah Center for Wildlife Education to 10 Commission members who have lost their lives in the service of wildlife conservation. Surviving family members were presented with folded North Carolina flags at the ceremony, which was attended by Wildlife Commission commissioners as well as many commission employees.

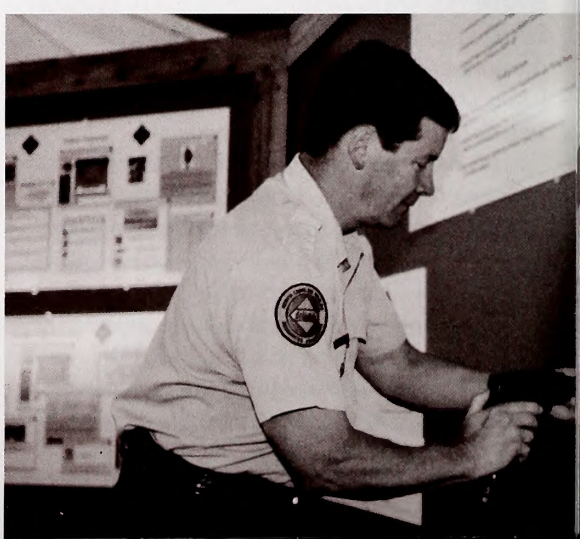
Already, 215,000 people have visited the facility, and nearly 9,000 have participated in the center's educational programs. Jim Bennett, chairman of the Wildlife Commission, noted that the Pisgah Center for Wildlife Education "will soon be a national educational model" to help people develop the skills and knowledge to make informed decisions about wildlife and the environment.

***Associate** editor Rodney Foushee and designer Erin Hancock choose slides for a magazine layout (right). Photographer Ken Taylor (below) sets up a display at the 1998 State Fair in Raleigh.*

◆ *Wildlife in North Carolina* Magazine

During the biennium, *Wildlife in North Carolina* again was named best state and federal wildlife and natural resource magazine in the United States and Canada by the Association for Conservation Information. This was the third first-place award the magazine has received in this competition in the last five years.

The magazine added 10,000 new subscribers during the biennium, with paid and complimentary subscriptions now nearing 70,000. Part of the magazine's circulation growth resulted from a successful direct-mail piece that was run in the summer of 1997, but the magazine's continued improvement in both design and content has also played an important



MELISSA McGAW

role. In the fall of 1997, a new four-page section for children, "N.C. WILD Notebook," was added to the magazine with praise from parents, teachers and children themselves. The illustrated pages again show the commitment of the Division of Conservation Education to educate the children of the state about wildlife and the work of the Wildlife Commission.

Wildlife in North Carolina continues to strive for excellence to bring the conservation message to a very diverse audience of sportsmen and sportswomen, conservationists, parents, teachers and children.

◆ N.C. WILD Store

Since 1993, the Conservation Education Division has sold educational products through the "N.C. WILD Store," the Wildlife Commission's catalog in the pages of *Wildlife in North Carolina*. During the biennium, a record for product sales was established, and strong product sales have continued to accrue. A total of 36,000 products have been sold since 1993, bringing in more than $240,000.

WILD Store managers introduced a variety of new products during the biennium, headlined by a six-volume collection of the popular "Nature's Ways," the illustrated natural history columns published in *Wildlife in North Carolina* each month. Also introduced were fact sheets on marine fish, produced along with the Division of Marine Fisheries, and two posters—*Decoys of North Carolina* and *Frogs of North Carolina*, the first in a series of amphibian posters.

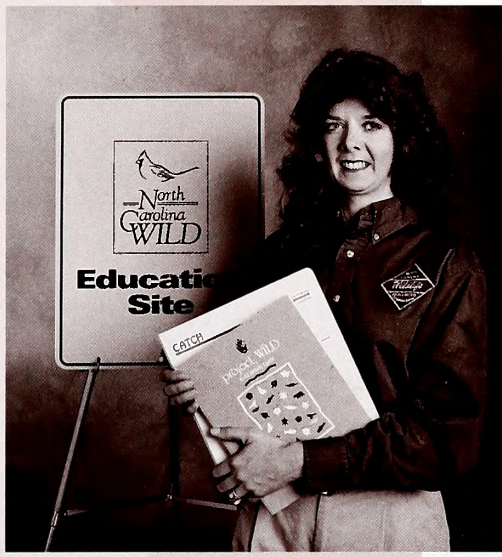
The revenue generated from the sale of items in the N.C. WILD Store catalog is used to support other educational programs and products.

RODNEY FOUSHEE

◆ Other Support Services

The Division of Conservation Education has also been strongly involved in many other activities and programs of the Wildlife Commission. The staff works with other agency programs to produce, design, photograph and offer editorial assistance with brochures, handouts, forms, posters and other publications. Staff photographers continue to lend invaluable assistance to the programs of the agency. For the first time, the division had a leading role in coordinating the agency exhibit at the 1998 State Fair. Through the efforts of all divisions, the display won the agriculture commissioner's.award for best noncommercial exhibit. ⊠

Celeste Wescott Maus ◆ *Field Supervisor/Program Coordinator*



MELISSA McGAW

I provide support, leadership and hands-on experience in my role as Field Supervisor and Program Coordinator. My primary responsibilities include supervising the Conservation Education Division's regional education specialists and coordinating the N.C WILD and the N.C. CATCH programs. In addition, I write, edit and contribute to numerous publications; network with a variety of audiences and agencies; and coordinate efforts between potential partners statewide and nationally.

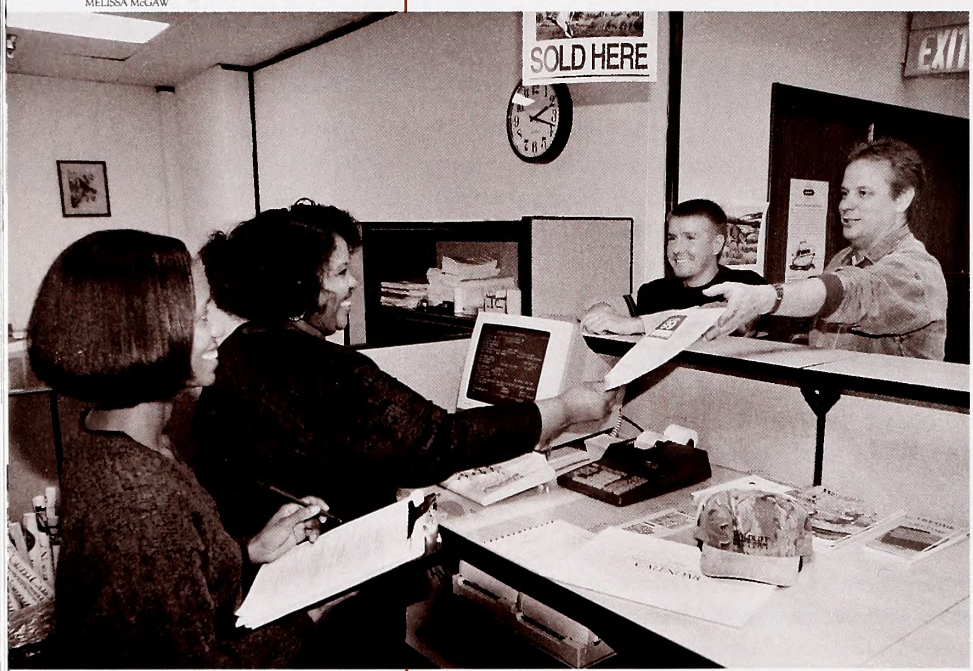
I particularly enjoy the direct contact with a talented team of education specialists. Together, we have produced and facilitated the N.C. WILD and N.C. CATCH programs across North Carolina. Both programs have been recognized through national awards and serve as models for other states as well as other North Carolina organizations and resource agencies. Our programs are requirements for the nationally acclaimed North Carolina Environmental Education Certification program.

Through working with a multitude of educators, youth leaders and experts within and outside our agency, I try to open windows of opportunity, creativity and leadership for both our staff and programs. I firmly believe that wildlife and aquatic education programs build bridges and provide universal tools for teaching, learning and doing. Education is truly the common thread that binds all living creatures together.

Administrative Services

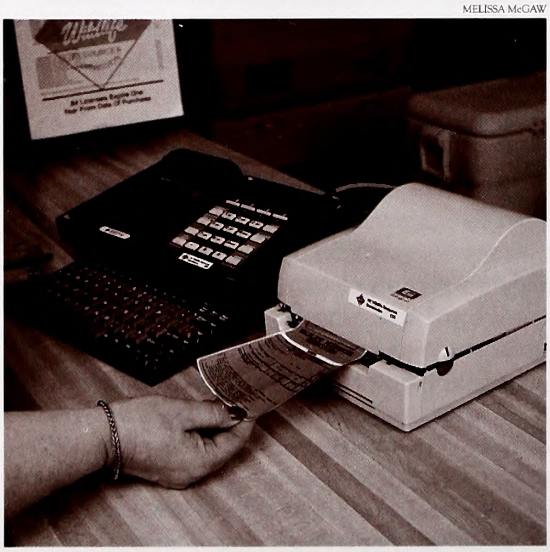
The Division of Administrative Services provides administrative and technical support to the Wildlife Resources Commission in accounting, purchasing, human resources and management of information systems. The division also administers the sale of hunting and fishing licenses and the registration and titling of boats to the public. Administrative Services is using technology to improve services provided to the Commission and the public. The most recent changes in the division have been the addition of the Personnel Section and the creation of a separate Technical Support Section.

MELISSA McGAW



***The Customer** Support Section based in Raleigh is responsible for the sale of hunting and fishing licenses, boat registrations as well as the sale of* Wildlife in North Carolina *and other educational products sold by the Wildlife Commission. Sophia Gwyn (left) and Shelia Rand help customers at the sales desk.*

MELISSA McGAW



This change in the structure of the division responds to the need for modernized information systems, improved efficiency and better customer satisfaction.

◆ Financial Management

The finance unit handles the accounting, budgeting and payroll for the Wildlife Resources Commission. In the 1997-1998 fiscal year, the Financial Management Section of the Administrative Services Division underwent some key personnel changes in order to provide the Commission the best service possible in its daily needs as well as its short- and long-range planning of financial matters. A chief fiscal officer was hired to oversee the day-to-day operations of the finance section, and a federal funds accountant position was added to assist the divisions in tracking their federal and state assistance and to look for other avenues of funding. Other changes included moving the payroll function from Human Resources to Finance, and moving personnel to assignments more suitable to their individual talents. In the future, the Office of the State Controller will be implementing extended financial modules of the North Carolina Accounting System (NCAS) such as purchasing and inventory. The Wildlife Enforcement Division was the first to implement the on-line requisitioning module of NCAS in early October 1998, which affects accounts payable as well as purchasing.

◆ Purchasing/Warehouse

Purchasing issued an updated purchasing manual during the biennium and underwent an extensive audit by the State Purchase and Contract office that resulted in minor exceptions. A time-limited position was added to assist in training and problem solving and to provide technical guidance as the Commission moves to implementing the on-line requisitioning module of the state purchasing system. The new module is expected to provide a more efficient, timely and computerized method of conducting purchasing and processing accounts payable for the Commission.

The warehouse underwent major changes during the past two years. The stockroom was transferred from the warehouse to the Customer Support Section in order to provide better services to the Commission and to make full use of staff. Renovations to the warehouse were completed to promote a more efficient, safer working environment that will allow the warehouse staff to improve the process of stocking and supplying the agency's inventory needs. Future projects include a new software program for tracking

inventory that will provide users better information and reports, and additional storage space to be built on the warehouse grounds.

◆ Customer Support Services

The Customer Support Section is responsible for the sale of hunting and fishing licenses, registration and titling of vessels, the sale of *Wildlife in North Carolina* magazine and WILD Store products, administration of 1,000 wildlife service agents, and all data entry and processing for the agency.

The Customer Support Section consists of five units.

Data Entry—This unit is responsible for providing data entry support to all agency divisions and programs.

Direct Sales—This unit is responsible for the sale of *Wildlife in North Carolina* magazine, the *North Carolina Wildlife Calendar*, and WILD Store educational products such as books, posters, videos and teaching aids. In addition, the unit handles all telephone sales and counter sales, including license sales and vessel transactions.

Help Desk—This unit is responsible for answering technical and program questions from agents, as well as questions from the public concerning hunting and fishing licenses.

Revenue Management—This unit is responsible for the collection of all revenue for the agency and for depositing funds with the state treasurer.

Transaction Management—This unit is responsible for processing all correspondence from wildlife service agents, vessel registration and titling transactions, and hunting and fishing license transactions.

The Customer Support Section has been challenged with many new tasks since the implementation of an automated computer licensing system in July 1997. This system allows the sale of licenses and vessel transactions statewide through point-of-sale computer terminals. It was designed to make the purchase of boat registrations and licenses more efficient and convenient to the customer and to automate the accounting process. Since the implementation of this system, the Commission has been able to better meet public needs by offering more services at convenient locations. This section also provides the use of toll-free numbers to renew vessel registrations and to purchase hunting or fishing licenses using a MasterCard or Visa credit card.

Members of our staff were able to visit many locations throughout the state to conduct training seminars for the wildlife service agents. Agents were able to learn about the equipment, operating procedures and the documentation procedures necessary to complete license and vessel transactions. In addition to creating a stronger database, the system has reduced the amount of paperwork and time required for an agent to process a transaction.

◆ System Technical Support

The System Technical Support Section has undergone many changes over the last two years. Implementation of the new Customer Support System and increasing Commission needs for automation created a demand for services that has been a challenge to support. In an effort to maximize manpower and provide better support, the technical group was moved from the Customer Support Section to a section of its own. This move enabled the section to have an information manager whose primary focus is supporting the Commission's computer operations and Customer Support System. In addition, contractors were hired to handle the demands that our permanent staff was unable to address. Demands on the section will continue to increase in the future as we prepare to assume more responsibility for managing the Customer Support System.

Lisa W. Hocutt ◆ *Manager, Customer Support Section*

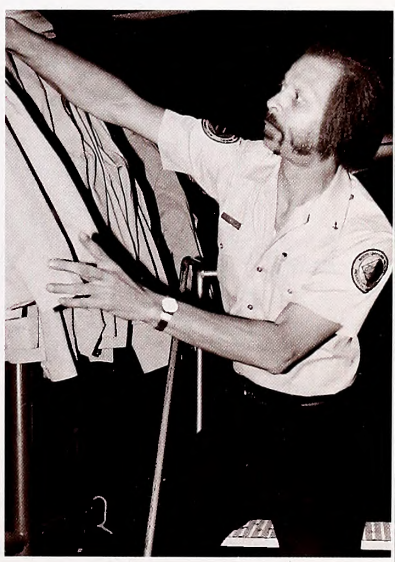
MELISSA McGAW

As manager of the Customer Support Section, I am responsible for overseeing the sale of hunting and fishing licenses, and the registration and titling of vessels in North Carolina. The section is divided into five units: Data Entry, Direct Sales, Help Desk, Revenue Management and Transaction Management. Each of these units has a unique responsibility, and together they work to streamline processes, centralize information and provide better customer service to the public. Unit responsibilities consists of processing vessel registration and title transactions; the sale of *Wildlife in North Carolina* and WILD Store products; the sale of hunting and fishing licenses; help desk services for 1,000 wildlife service agents and the public; collection of revenue; and data entry for the agency.

This position is very challenging and it allows me to work with staff to ensure the services provided by the Wildlife Resources Commission are the most efficient and convenient to our customers. I am fortunate to work with people who are dedicated to our agency. I also enjoy the opportunity of working with other divisions within our agency, providing input on new system design and development to guarantee the most efficient system to our citizens.

We will continue to provide our customers with the best service possible.

***Robert Baker** manages the Commission's warehouse to ensure that employees have the proper uniforms and other supplies.*



MELISSA McGAW

Administrative Services

MELISSA McGAW

The Wildlife Commission's Personnel Section has worked to improve worker safety during the biennium. Debbie Brown (standing) and Carol Batker go over some additions to the personnel policy.

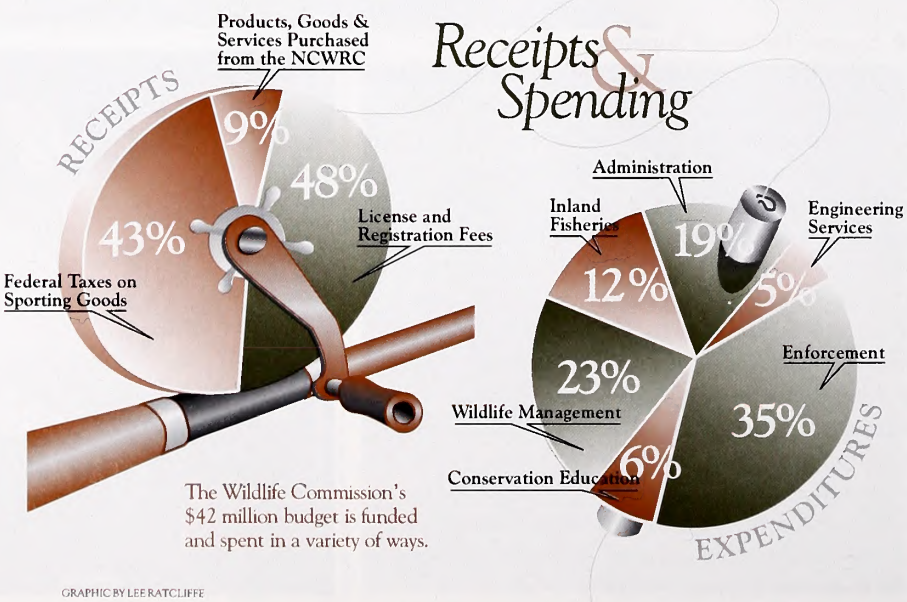
◆ Personnel

The goal of the Personnel Section is to provide the employees of the Wildlife Resources Commission with comprehensive human resources services, and to ensure that we can attract, retain and develop a skilled and motivated work force that is representative of the citizens of North Carolina. To encourage excellence, the Personnel Section seeks to promote fair and equitable treatment, provide continuing opportunities for training and development, recognize productivity and achievement, and respect the worth and dignity of all employees of the Wildlife Resources Commission. No project of the Wildlife Resources Commission can be accomplished without our employees, and we want to make sure that a support system is in place that allows them to concentrate on their work without worrying about personnel issues. To this end, we have recently reorganized some of the functions of the Personnel Section and have added an additional staff member. As the Wildlife Commission has grown, so has the need for services to employees. One of our major initiatives is to expand our Safety and Health program. Our goal is to provide our employees with a safe and healthy workplace through development of a safety manual, a workplace inspection program and accident analysis mechanisms. We have formed a committee of Commission employees to assist in this effort.

We also provide services to management in the form of position management and development. We offer consultation on position design alternatives so that managers are able to hire the right people to do the job they need, and we also assist managers in utilizing new compensation management techniques such as skill-based pay. In the past year we have made efforts, through the in-range salary adjustment policy, to provide more equitable compensation for the employees of the Commission.

We also developed a recruitment policy during the biennium. In keeping with a legislative mandate, we developed a policy and procedure to ensure that vacancies with the Commission are filled with the most qualified applicants. Some future projects include development of training for supervisors on interpreting and applying state personnel policies in their work units, offering pre-retirement seminars (PREPARE program), revising the Commission's employee handbook, working with the Office of State Personnel to develop more autonomy and implementing creative and cost-effective compensation policies.

The Personnel Section is here to serve the interests of the Wildlife Resources Commission by providing guidance, direction and interpretation of state personnel policies and procedures, as well as consultative services. We are committed to providing the best service possible to the employees of the Wildlife Resources Commission at an economical cost and promoting sound human resources management practices throughout the Commission. ⊠



The Wildlife Commission's $42 million budget is funded and spent in a variety of ways.

GRAPHIC BY LEE RATCLIFFE

N.C. WILD STORE

And now for our feature presentations.

Coming soon to a VCR near you. The N.C. WILD Store proudly presents four unique nature videos, featuring cameo appearances by an all-star cast of wildlife. Hurry and find your seats, as the outdoors comes indoors with four interesting and educational adventures the whole family can enjoy. Pop the corn, pour the sodas and dim the lights—the shows are about to begin. Sh-h-h...

ALL THINGS ARE CONNECTED

Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.

ITEM CODE **W1**

PROTECTING OUR WILDLIFE HERITAGE

25-minute video offers useful tips for landowners on managing small game. $20.

ITEM CODE **N8**

BRIGHT WATERS

30-minute video on fishing and fisheries management in North Carolina's freshwater creeks, rivers and ponds. $20.

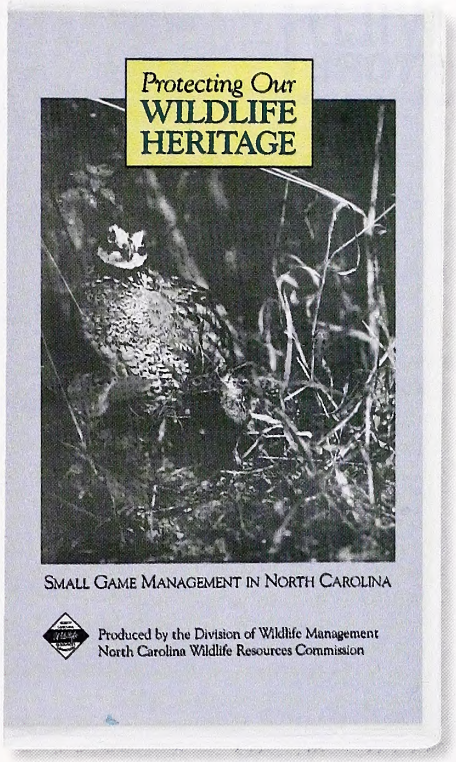
ITEM CODE **N7**

WILDLIFE BABIES

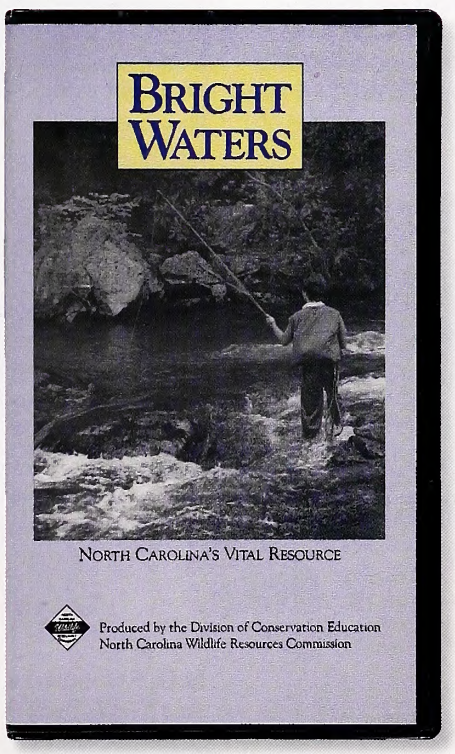
Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others. $20.

ITEM CODE **N9**

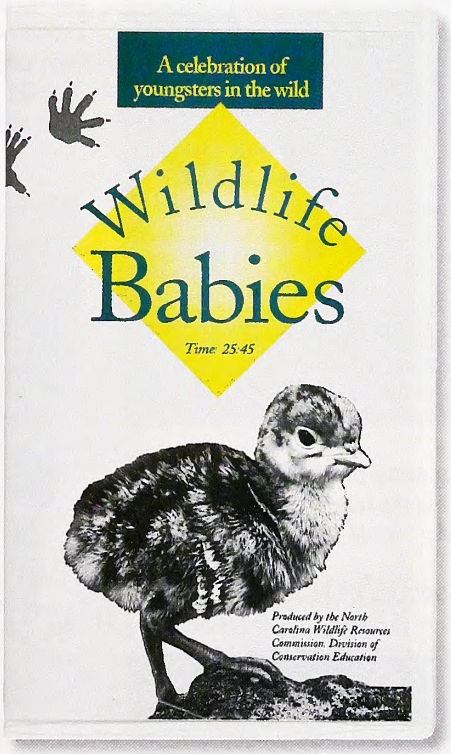
environmental ethics



habitat for small game



freshwater fish



youngsters at play

More terrific items

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

WATERFOWL DECOYS OF N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10. ITEM CODE P12

N.C. WILD CAP

N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50. ITEM CODE A1

WILDLIFE IN N.C. CAP

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE A3

FROGS OF N.C. (THE HYLIDS)

Presents all 15 of the state's tree frogs, cricket frogs and chorus frogs. 22" x 34". $6. ITEM CODE P11

WILDLIFE IN N.C. CAPS

Each embroidered with magazine logo and buck deer silhouette. Described left to right. $16.50 each.

Blaze orange with brown waxcloth bill. ITEM CODE A7

Advantage® Camouflage with tan suede bill. ITEM CODE A6

Sold Out! Stone with navy canvas bill. ITEM CODE A2

LIZARDS OF N.C.

12 of the state's lizard species. 22" x 34". $6. ITEM CODE P3

TURTLES OF N.C.

21 of the state's turtle species. 22" x 34". $6. ITEM CODE P4

SNAKES OF N.C. (LIVEBEARERS)

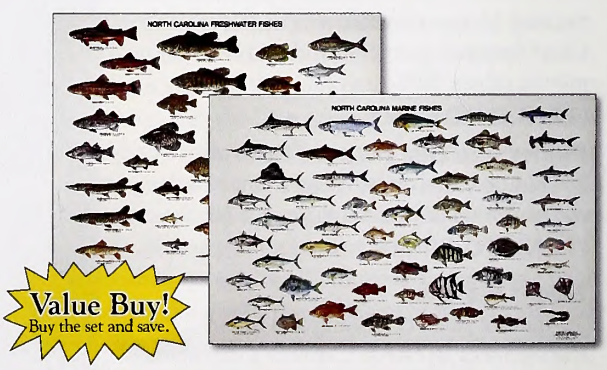
17 of the state's snake species. 22" x 34". $6. ITEM CODE P5

SNAKES OF N.C. (EGGLAYERS)

19 of the state's snake species. 22" x 34". $6. ITEM CODE P8

SET OF 4 POSTERS

Save $6 by purchasing the set of four posters (P3-P8). $18. ITEM CODE P10



N.C. FRESHWATER FISHES

Find your favorite fish with this color poster showing 36 of the state's freshwater fishes. 28" x 22½". $6. ITEM CODE P6

N.C. MARINE FISHES

All the colors of the sea can be found on this poster of 60 marine fishes. 35" x 22½". $6. ITEM CODE P7

N.C. FRESHWATER AND MARINE FISHES

Save $2 when you buy both posters as a set. $10. ITEM CODE P9

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50. ITEM CODE **M9**

Also available as a boxed set. $30. ITEM CODE **M10**

North Carolina WILD Places Map

Artist's Proof. $40. ITEM CODE **E2**
Limited Edition. $25. ITEM CODE **E3**
Poster. $6. ITEM CODE **E4**

Dogs that Point, Fish that Bite

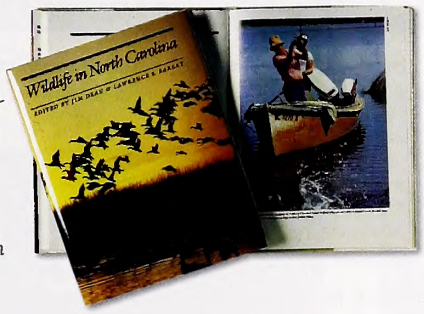
Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. $19.95. ITEM CODE **M8**

North Carolina WILD Places Posters

(Set of 3): Posters of "Old Field" and "Mountain Cove Forest" from *North Carolina WILD Places: A Closer Look*. 19 1/2" x 16". Shipped folded with poster version of WILD Places Map. $8. ITEM CODE **E5**

Wildlife in North Carolina Book

The best of *Wildlife in North Carolina* magazine. Hardbound. $12. ITEM CODE **M3**



Magazine Binder

Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. $10. ITEM CODE **M2**

WILD Places book and posters

Buy the *North Carolina WILD Places* book and all three posters and save! (Items E1 and E5) $16. ITEM CODE **E6**

Value Buy! Buy the set and save.

Bird Houses & Feeders: How to Build and Enjoy Them

An eight-page illustrated guide to building bird houses and feeders. $2. ITEM CODE **M6**

North Carolina WILD Places: A Closer Look

Easy-to-read text and Anne Marshall Runyon's delightful illustrations make wildlife habitats come alive in this 82-page book. Discusses 13 habitats across the state. $10. ITEM CODE **E1**

Scouting Correlations

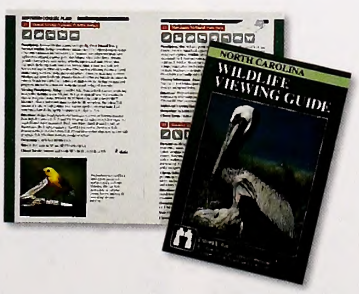
Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each $3.
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**

North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. $6. ITEM CODE **E7**

North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. $5.95. ITEM CODE **N6**



North Carolina WILD Journal

Handy calendar notes on wildlife behavior through the year, with room for personal observations. Supplements N.C. WILD Education Sites workshop. $6. ITEM CODE **E8**

More terrific items

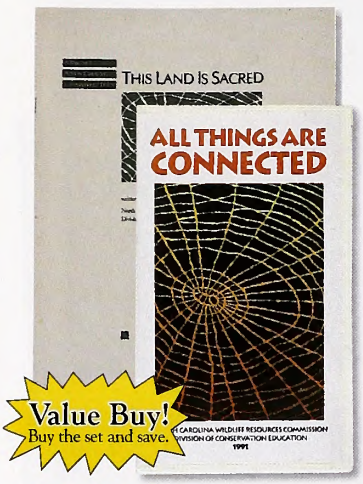
N.C. WILD STORE

All Things Are Connected & This Land Is Sacred

Video and Teacher's Guide package. $22. ITEM CODE W3

Gardens for Butterflies

Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. $2. ITEM CODE M5



All Things Are Connected

Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.
ITEM CODE W1

This Land Is Sacred (Teacher's Guide)

Classroom activities to accompany All Things Are Connected video.
$4.50. ITEM CODE W2

White, 100% cotton (preshrunk) T-shirts are guaranteed for comfort and durability. Each shirt features an original design.

Wildlife in N.C. T-shirt

WINC magazine logo on front pocket. Tundra swan art on back. $14.50.
ITEM CODES:
A5MED (medium)
A5LRG (large)
A5XLG (extra large)
A5XXL (extra extra large)

N.C. WILD T-shirt

N.C. WILD logo printed on front and colorful art on back. $14.50.
ITEM CODES:
A4MED (medium)
A4LRG (large)
A4XLG (extra large)
A4XXL (extra extra large)

WILDlife Profiles

Each set is designed to fit your standard 3-ring binder and features 10 animal fact sheets. $2 per set.

Set 1. Black bear, raccoon, white-tailed deer, striped skunk, bobwhite quail, wild boar, muskrat, mourning dove, coyote, mallard. ITEM CODE W4

Set 2. Mink, canvasback duck, red fox, wild turkey, beaver, American river otter, Canada goose, bobcat, red wolf, cougar. ITEM CODE W5

Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass. ITEM CODE W6

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.
ITEM CODE W7

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster. ITEM CODE W8

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat. ITEM CODE W9

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.
ITEM CODE W10

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad. ITEM CODE W11

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish. ITEM CODE W12

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet. ITEM CODE W13

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet. ITEM CODE W14

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.
ITEM CODE W15

N.C. WILD Notebooks

Each set contains eight issues of *North Carolina WILD Notebook*, the Commission's prize-winning conservation education newsletter. $3 per set.

'95-'96 Set ITEM CODE E11
'96-'97 Set ITEM CODE E12

Coming Soon!

WILDlife Profiles Binder
Organize WILDlife Profiles with this notebook binder complete with table of contents, species tab dividers and index.

Traditional Trout Flies of the Southern Appalachians
Framable, high-quality poster is the second in the "Sporting Heritage" series.

An Investment in Wildlife

KEN TAYLOR

South Mountains Game Land

KEN TAYLOR

Bladen County Game Land

KEN TAYLOR

KEN TAYLOR

MELISSA McGAW

NORTH CAROLINA WILDLIFE ENDOWMENT FUND

Your purchase of a lifetime hunting and fishing license or subscription to Wildlife in North Carolina *is more than a good financial deal; it is an investment in wildlife. While the principal from these sales is held in the N.C. Wildlife Endowment Fund, the interest is used for important wildlife conservation projects, including the purchase of game lands to ensure that wildlife always has room to roam.*

Progress for Wildlife

Whether restoring striped bass or wild turkeys, using dogs in wildlife enforcement or educating the public, the Wildlife Resources Commission is making progress for wildlife conservation in North Carolina.

Cover photo credits (clockwise from left): Rodney Foushee, Ken Taylor, Melissa McGaw, Ken Taylor, Ken Taylor

Periodicals postage paid at
Hickory, North Carolina

LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
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WILDLIFE IN NORTH CAROLINA

FEBRUARY 1999 $1.50

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Mr. and Mrs. Lassiter

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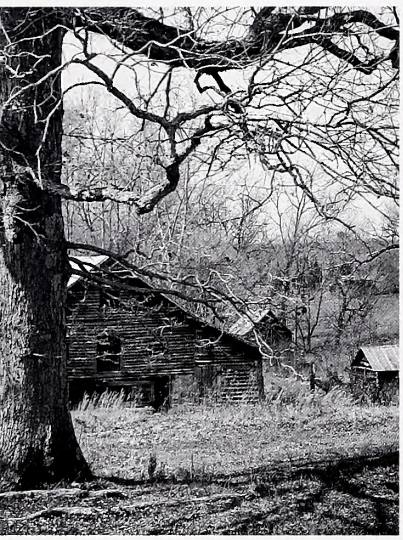

LAWRENCE S. EARLEY

"He didn't make no mistake," he says fiercely, still looking at the gaping cut. "He run with the wrong crowd. I told him. He knew it."

"Anybody can make a mistake," Christine says softly, her eyes lowered to the purse. Her brown fingers nervously caress the pebbled grain of the leather. It is sometime in the 1960s—I don't recall exactly—and I have followed the setter Mack across the frozen Northampton County fields from my grandparents' adjacent farm to visit this family I have known all my life. But I have walked into the hard-packed, grassless yard at a bad time, and I stand uneasily under the big oaks, cradling the shotgun in the crook of my elbow. The men around the scalding vat are silent, working intently in the steam and smoke. Though they know me well, they barely nod.

Arthur stops the big kitchen knife halfway down the hog's stark, white belly. Two other hogs are hanging by their back feet, hairless.

"He didn't make no mistake," he says fiercely, still looking at the gaping cut. "He run with the wrong crowd. I told him. He knew it."

Christine doesn't look up right away. She opens the purse and looks inside. A pocket, stitched neatly on the side, is for change.

"Well, he made it for me," she says. And after a pause, she adds, "even if it is a Caldonia pocketbook." She uses the term casually, a word as familiar to all of us as John Deere or Halifax.

"Besides, you ain't got no money to put in it," Arthur says, his voice suddenly gentle. As he finishes the cut, one of the other men shoves a big washtub under the hog to catch the guts that pour out, dark blue and swollen. There is not much blood. Christine's sisters and aunts are standing at a long table covered with white paper. They have already begun to cut out the tenderloins, work up the sausage and wrap other parts in white paper. Arthur's aunt Aida is stripping out the chitterlings. Aida is old, yet ageless, looking the same as she did was when I was a child and she sometimes looked after me. Once, she caught me stealing molasses in the pantry, but she never told my grandmother, just laughed as she wiped me off roughly with a wet dishcloth.

Any other time, all of us would have slapped backs, laughed over some old familiar tale, and I would have left with a package of sausage.

Mack sniffs the washtub and the hogs then stands by the well expectantly, knowing that I would usually crank up the bucket and pour him a drink in the enameled dish pan. When I make no move to do so, he ambles back to the men. I would like to leave, but I don't know how without causing more embarrassment.

Arthur and I have known each other a long time, too, since we were children, back to World War II, when my mother and I lived with my grandparents while Dad was overseas. Arthur's father had worked for my grandfather then, and, in the years that followed, Arthur and I had hunted rabbits with him, sharing an old single-barrel shotgun with black tape wrapped over a split stock. Arthur's father was a big, jovial man who teased us because we couldn't cross a peanut field without filling our pockets from the stacks. "You boys gonna make yourselves sick on them raw goobers," he would tell us. "And you cain't shell 'em and be ready for no rabbit, neither. It's a wonder anybody brings a crop home with you two 'round."

Arthur hunkers down and scratches Mack's ears absently. He looks at Christine, the anger now gone. Christine holds the purse out for a brief moment so I can see it, then she carries it to the house. The leather is white and the edges are whipped with thin black lacing, the kind that I remember using at Boy Scout camp to make square lanyards.

In that now distant time 30 some years ago, a bleak grouping of buildings surrounded by wire on creosote poles sits in fields that stretch to the distant woods. In summer, inmates at Caldonia Prison Farm work the fields, and I occasionally see them on the shoulders of the roads with bush axes, hot and sweating, watching me pass in the old Plymouth that my parents owned. There would be a bus parked nearby, and a guard with a shotgun.

Arthur stands up slowly shaking his head at me in a way that reminds me of his father, then he looks towards the house where Christine is putting away their son's gift. I want to tell him something, but all I can think of is, "Blood will tell, Arthur."

He shakes his head again wearily. "Come back," he says.

I get the water from the well and give Mack a drink. Then I follow the setter back into the field, into light that seems almost fluorescent.

Contents

Wildlife in North Carolina

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

February 1999 *Volume 63, Number 2*

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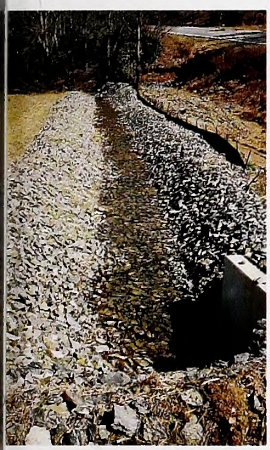
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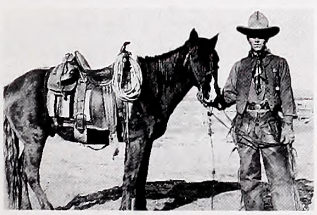
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Cover *This ruffed grouse was caught proudly strutting on a woodland log. Photograph by Len Rue III.* ©1999

Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 1-800-662-7726. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Life in the Basement

written by Jeff Beane ©1999
illustrated by David Williams

One of my favorite lines from Dr. Seuss used to be, "Dig a hole five furlongs deep, down to where the night snakes creep." Though there aren't really any night snakes—or much else—living at that depth, there is a world beneath our feet that we seldom acknowledge.

Since living things have exploited virtually every type of habitat on the Earth's surface—and well above it—it should come as no surprise that many have adapted to life beneath its surface as well. Creatures that spend most of their time underground are known as *fossorial* animals. Since we can't readily observe them, it is not surprising that fossorial creatures are among those that we know the least about.

In Earth's basement, swarms of bacteria, fungi, protozoans, worms, arthropods and numerous other organisms live secret lives. A spadeful of garden soil may contain millions of nematodes. Some creatures, such as earthworms and worker termites, may spend their entire lives underground, never surfacing. Others, like cicadas, may tunnel for as long as 17 years as nymphs before switching suddenly to the other extreme—a final, brief stint in the treetops, where they will mate and produce the next generation of nymphs scheduled for long tours of underground duty.

Some crayfish species travel far from water and dig deep burrows down to the water table, thereby avoiding many of the predators they would face in a stream or pond. In some ephemeral wetlands, their burrows serve as refuges for other aquatic animals during droughts.

Numerous vertebrates also live underground. The eastern spadefoot toad spends most of its life buried in sandy soil, normally emerging only briefly during heavy rains for breeding and feeding. A hardened, sickle-shaped "spade" on each hind foot aids in digging, and the toad's glandular skin helps prevent it from drying out. Other fossorial amphibians include the gopher frog and the mole salamanders of the genus *Ambystoma*, which spend most of their adult lives in burrows, emerging only for their annual breeding migrations.

With their elongate bodies, snakes are likely candidates for fossorial behavior, and many are indeed expert burrowers. The adaptations of one of our most fossorial species, the tiny worm snake, include a flattened head, small eyes, and only 13 rows of dorsal scales, the lowest number of any of our snakes. Fewer rows of scales may help reduce friction. Most burrowing snakes tend to be small, but the northern pine snake, an accomplished burrower, may exceed 6 feet in length. The enlarged scale on the tip of its snout, known as the rostral scale, assists in digging. Females often dig their own nest burrows.

Many mammals mark time underground. The burrowing habits of groundhogs and chipmunks are well known, but even animals as large as coyotes spend considerable time in subterranean dens. None, however, are better adapted than moles—the masters of the basement. The impresive burrowing adaptations of North Carolina's three moles—eastern, hairy-tailed and star-nosed—include compact, streamlined bodies; powerful, highly modified forelimbs with heavy claws for digging; velvety, friction-resistant fur; tiny eyes ("Use it or lose it" is one of Nature's toughest rules); valved ear openings to keep out dirt; and a keen tactile sense. The star-nosed mole's bizarre snout is equipped with 22 sensitive tentacles for prey detection. Moles are essentially uniformly colored, having no need for the dark back/light belly color scheme that serves as protective coloration in most mammals. Albino moles are relatively common, probably for the same reason—abnormal coloration offers no great disadvantage to a creature that lives in darkness. Numerous animals utilize mole tunnels for their own underground activities. Moles are such heralded burrowers that several other fossorial creatures (mole crickets, mole salamanders, mole skinks, mole kingsnakes, mole rats) have been named after them.

For many years I worked in a basement office at the N.C. Museum of Natural Sciences, often feeling secure in the knowledge that the clamoring hordes of visiting schoolchildren were confined to the floors above me. Now I have a new office with a window, but I sometimes miss those basement days. When I walk outside, I wonder what creatures beneath my feet feel similarly secure from my intrusive trampling just above.

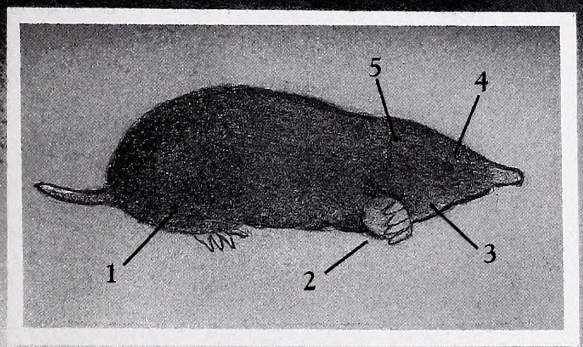
Other Reading

* "Life in the Dark Lane," Jane Rohling, *Wildlife in North Carolina* (May 1985).
* "The Longest Wait," Lawrence S. Earley, *Wildlife in North Carolina* (May 1994).
* "Wonderful Worms," Lawrence S. Earley, *Wildlife in North Carolina* (April 1981).
* Arthur N. Bragg, *Gnomes of the Night: The Spadefoot Toads* (University of Pennsylvania Press, Philadelphia, 1965).

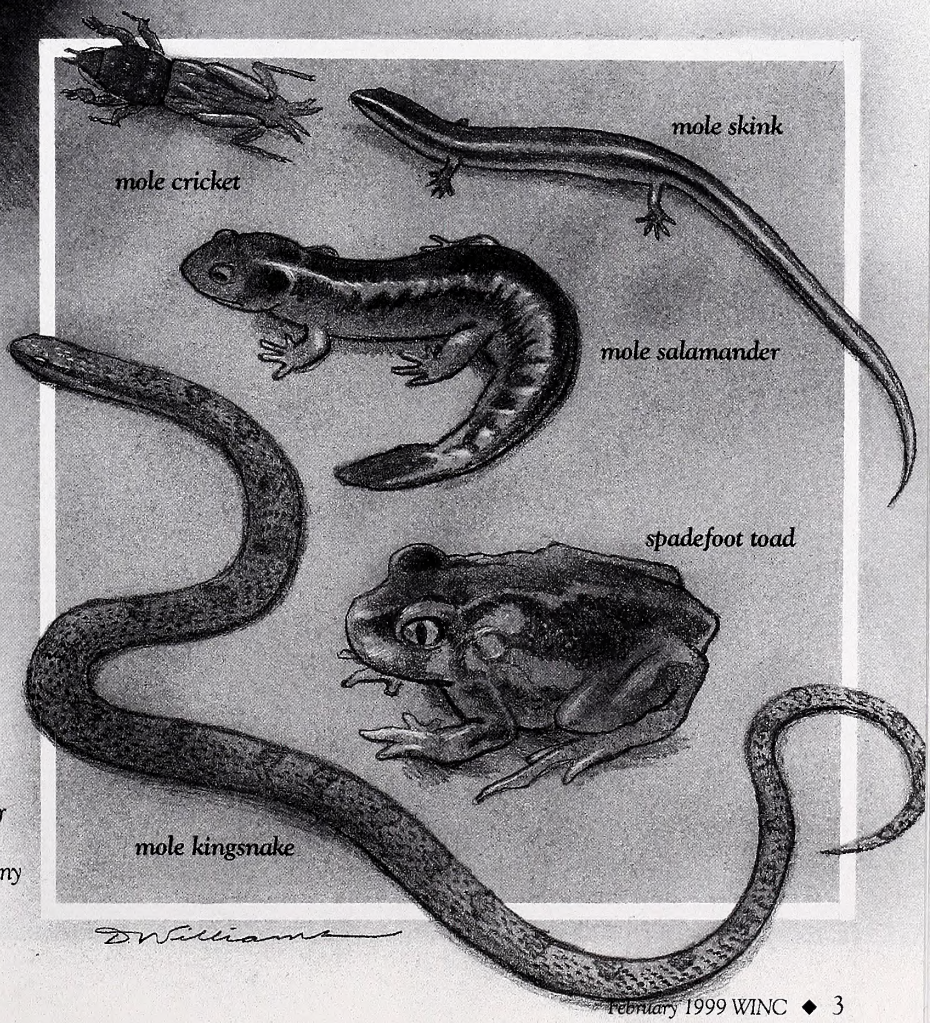
Surfing the Web

* Information on moles may be found at this web site. *Address:* http://www.entm.purdue.edu/Entomology/Urbancenter/pubs/moles.html
* This web site contains information on the role of earthworms in soil-building. *Address:* http://maine.edu/~thomascb/earthworm.html

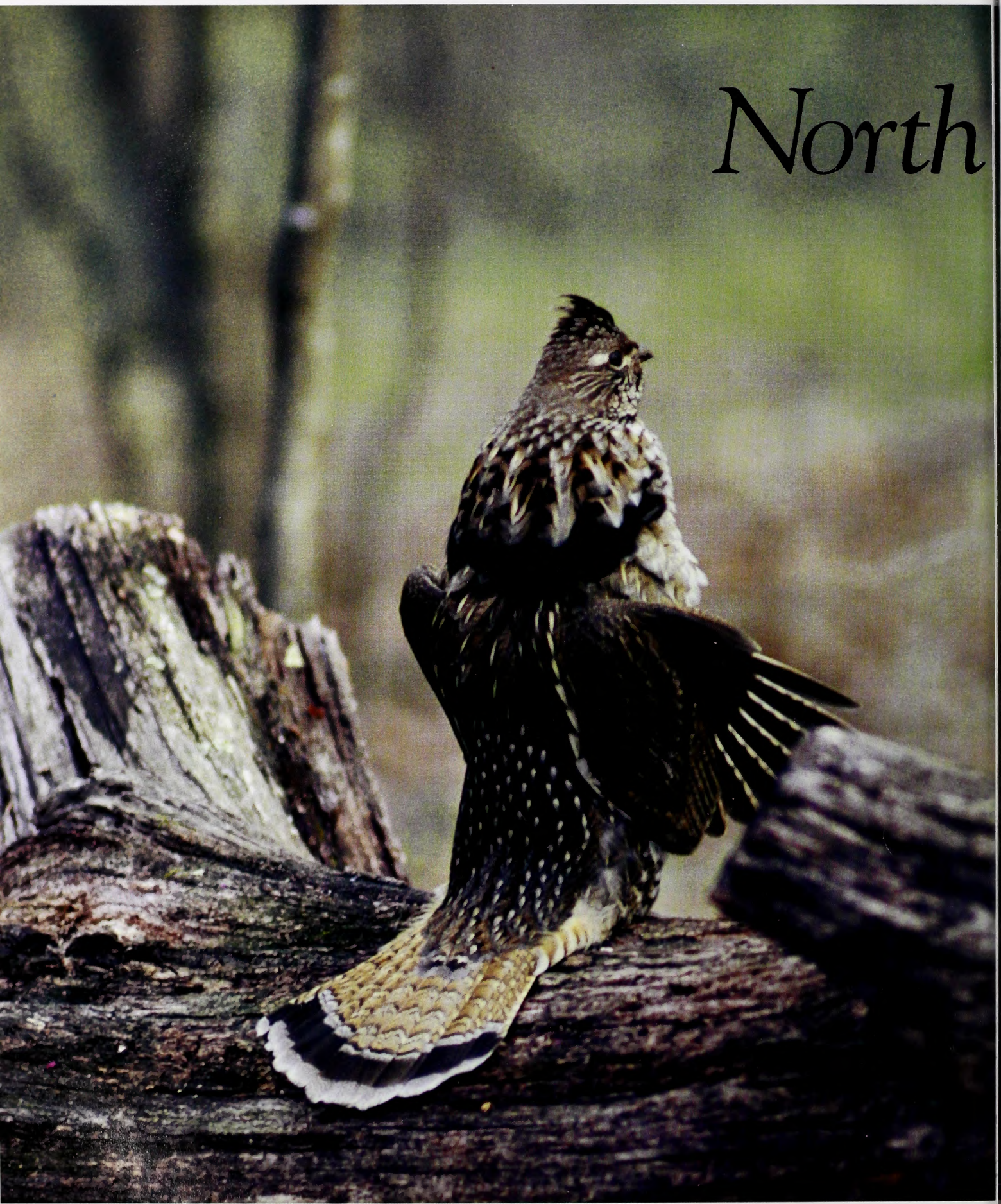
One of the most familiar of *our fossorial species is the eastern mole. This species digs two types of burrows—a temporary burrow excavated several inches below the surface and used when the moles are hunting for earthworms, insects and other food; and a more permanent burrow that is dug as much as 2 feet below the surface.*



North Carolina's three mole *species have a variety of adaptations for burrowing: compact, streamlined bodies (1); powerful, highly modified forelimbs with heavy claws for digging (2); friction-resistant fur (3); small eyes (4); ear openings with valves to keep out dirt (5); and a keen tactile sense.*



Fossorial species prefer *living underground for much of their lives and they make their way by excavating burrows. Among these species are many that have been given the name "mole" to signify their mole-like habits.*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Carolina's RUFFEST GAMEBIRD

No game bird is tougher to bag than a ruffed grouse. Here's a look at how to get in on some of the state's best wingshooting, if you don't mind working your tail off.

written by David Hart ©1999

DAVID HART

Compared to most other game birds, ruffed grouse are pretty slow. And it doesn't take much to knock one down. A few pellets from a load of No. 7½s will usually do the trick. So why haven't I killed a grouse the last three times I went after them? Why will I come home empty-handed from the next trip I take into the mountains after ol' ruff? For that matter, why do I keep going grouse hunting?

It certainly isn't for the meat, although grouse breast cooked on a bed of wild rice is superb. Fewer types of hunting have such little return for the sheer amount of energy expended.

To put it simply, grouse hunting is addictive. Each time my friends and I go, we leave bruised, scratched, blistered and determined to keep going back no matter how few birds we kill. We go for the same reasons duck hunters slog through a marsh in a bitter cold, driving rain. We go for the same reasons turkey hunters dodge rattlesnakes, pluck bloodsucking ticks from their skin and come home empty-handed nearly every time they go out.

Why? Because we're idiots. What other explanation is there?

Few, if any, game birds are such a challenge to hunt as the ruffed grouse. In fact, a successful day of hunting is not measured by the number of birds brought to hand. Instead, grouse hunters judge a day by the number of birds flushed. According to surveys conducted by the N.C. Wildlife Resources Commission, a typical grouse hunter flushes about one bird for every hour of hunting. Kill rates are even lower, with hunters bringing home an average of 0.6 bird per trip. Of course, not everyone is a "typical" grouse hunter. If you know where to look, you can find enough birds to make an interesting, and exciting day. And you might bring home more than a fraction of a meal.

***Take a good look at** this ruffed grouse, because it is a sight most hunters are lucky just to get a glimpse of. A successful day afield is measured not by the number of birds brought to hand, but rather by the number of birds flushed.*

Finding Them Is Half the Battle

"The best place to look for grouse is in clear-cuts," said Mike Carraway, a biologist with the Wildlife Commission. "Concentrate on clear-cuts from 5 to 15 years old. Those are going to provide the birds with the best cover and food sources, so those are the best places to start looking."

Nearly all of the state's national forests in the western mountains are sprinkled with hillsides that have been logged, so Carraway declined to pick any specific counties or areas. "They're all good, if they have what the grouse need. But if you find a clear-cut, you'll usually find the grouse," he added.

Like any other wild animal, ruffed grouse need the basics for survival—food and shelter. Water is of less importance. They get moisture both from their food and from rain and condensation.

"Most important is overhead protection and a relatively open floor," Carraway said. "Avian predators, particularly hawks, kill the most grouse, so grouse usually hang around thick stands of smaller trees. Hawks can't really fly through them, so

A pair of hunters *(right) stand at the ready as their dog works over a "birdy" area. In North Carolina, good grouse habitat can be found in areas that have soft mast such as wild grapes, greenbrier and blackberries. But finding grouse is only part of the battle. To bring one down, hunters need quick reflexes and a durable, lightweight shotgun. After taking a grouse, a hunter (below) shares a triumphant moment with his bird dog.*

DAVID HART

DAVID HART

the grouse are relatively safe."

It's also important that the cover have a relatively open floor. That way, grouse can see ground-dwelling danger like foxes and bobcats approach before it's too late.

In the northern states, where grouse is king and hunters never have a shortage of birds, these popular game birds rely on aspen trees and a few other critical foods. But we don't have those white-barked trees in North Carolina, so don't bother looking for them. Instead, concentrate on other soft mast. Wild grapes, greenbriers, blackberries and raspberries are obvious and often generously scattered throughout an older clear-cut or other opening in the thick, mature forests of the mountains.

Steve Henson, habitat chairman for the Southern Appalachian Chapter of the Ruffed Grouse Society, agreed and added that if you're not getting scratched up from the cover, you're probably not looking in the right place.

"The best grouse cover is the stuff you would normally avoid walking through," he said.

No matter where they start looking for birds, Carraway advises grouse hunters to avoid open, mature woods. There might be a few birds in the thicker parts of the older oaks, but that type of habitat just doesn't provide grouse the food or safety they need in order to survive.

"Think like a grouse," he said. "Would you live where a hawk could swoop down and pluck you off the ground in an instant?"

If you've found good habitat but still haven't jumped any birds, try heading uphill. In areas of high hunting pressure, particularly those close to roads, grouse tend to become pretty wary. They've grown accustomed to the ways of men, guns and dogs and will often rocket to the top of the mountain and stay there if it provides them with food and shelter.

If you still can't find birds, Henson suggests calling on Forest Service employees who might know some productive haunts.

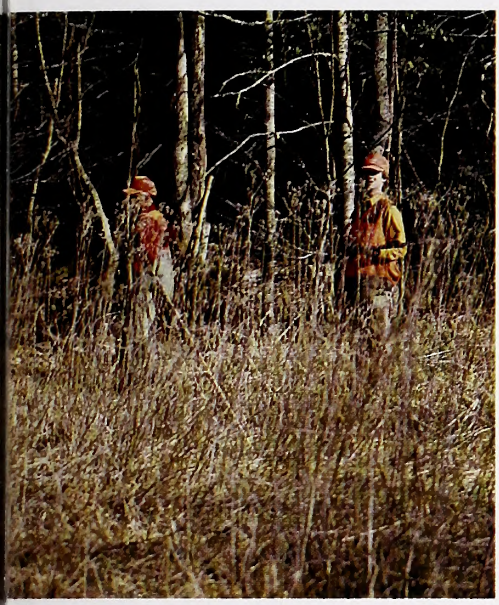
"I usually just ask them where I might find older clear-cuts," he said. "If I can, I'll stop by their office with a topographic map and have them mark some areas on the map. These guys know every clear-cut in the county. That's why they are such a big help."

One thing you shouldn't expect these Forest Service employees to do is give away their own favorite grouse hunting areas. Although these places may be on public land, personal hotspots are guarded like classified information. As a group, ruffed grouse hunters are some of the friendliest, most honest hunters you'll meet, but few would dare give away their "secret" covert.

As with any type of hunting, spend enough time in the grouse woods and all the pieces will eventually fall into place. You'll quickly learn which areas to hunt thoroughly and which areas to avoid.

The Right Equipment

There are scads of grouse hunters who spend thousands of dollars on shotguns that see the light of day only during grouse sea-



KEN TAYLOR

son. And it's a safe bet that some of these hunters are divorced. Sure, a custom-made, lightweight 20- or 28-gauge double would be pure joy to carry, but don't trade in your rusty old 12-gauge pump yet. You don't need to. I'm convinced the best grouse gun is the one that you are most comfortable with. So does Henson, who has been chasing grouse for about 30 years.

"People ask me what the best gun is, and I just tell them it's the one you can shoot well and carry for six or seven hours at a time," he said.

I use a 12-gauge over-and-under, and I think it shoots pretty well, but after four hours of picking my way through jungle like habitat, the gun feels like it's made of lead. My arms ache, and I'm glad to see the end of the hunting day. I own a lighter pump gun, but frankly I can't hit anything with it, so I stick with the heavier two-barrel. It's a matter of trade-offs.

If you have a choice, pick a shorter-barelled 12-, 16- or 20-gauge (28-gauge or .410 if you are borderline insane) loaded with No. 7½s or No. 8s. That's all you really need. If you're a halfway decent wing shot, you shouldn't have any problem knocking down a bird or two.

"I've heard of some hunters using No. 9s or even No. 6s," Henson added. "I usually use basic target loads with No. 7½ or No. 8 shot and do pretty well."

Equally important is a good pair of boots. Like gun choice, footwear selection boils down to what pair feels the best. If you have several to choose from, pick the lightest pair that offers good ankle support. You'll need it.

I also wear leather gloves to keep my hands from becoming a bloody mess, and I protect my legs with a pair of bird pants. They have a layer of tough canvas across the thighs and keep needle-sharp thorns from carving my skin.

A blaze orange hat or vest is critical, also. It's hard enough to keep track of your partners in the grouse woods, so a splash of orange may make the difference between squeezing the trigger or passing up a shot at a bird that flushes between the two of you. Besides, it's the law.

The Other Half of the Battle

If actually finding a few birds is hard, knocking one out of the sky is even harder. Grouse may be slow, and perhaps even a bit dumb, but they aren't stupid. If they were, I'd come home with a limit every time I left the house, and the mountains would be jammed with happy-go-lucky bird hunters.

Those who pursue ol' ruff for the first time have a hard time getting off many shots. They wait for the perfect opportunity to pluck a bird out of the sky with a clean shot through unhindered air. Sure, and doves always fly in a straight line.

Getting a shot at a grouse means shooting through a veil of twigs, vines and brown, crumpled leaves still clinging to the trees. It means keeping your gun ready at all times. And it means predicting the direction the bird will turn the moment you squeeze the trigger. In other words, don't plan on getting many shots at the birds you flush. Remember, a successful day is measured in the number of birds seen or heard, not killed.

Ruffed grouse are masters at thundering skyward when you are biting a thorn out of your hand or just after you've slipped and fallen on your backside. They are equally skilled at flushing from the backside of a tree or tangle of greenbriers and keeping the obstacle directly between you and them. It's almost as if they elicit some sort of pleasure from scaring the pants off you, then taunting you as they fly to safety.

The Ruffed Grouse Society

The Ruffed Grouse Society is a 20,000-member, nonprofit organization dedicated to improving habitat for ruffed grouse, woodcock and other forest-dwelling wildlife. The group assists federal, state and private landowners in habitat enhancement programs. For more information, write the society at 451 McCormick Road, Coraopolis, Pa. 15108, or call (888) JOIN RGS. To join the Southern Appalachian chapter, which has members in South Carolina, Tennessee and North Carolina, call chapter President Steve Evans at (828) 667-0958.

That, of course, is why grouse hunting is so exciting, so frustrating and so addictive.

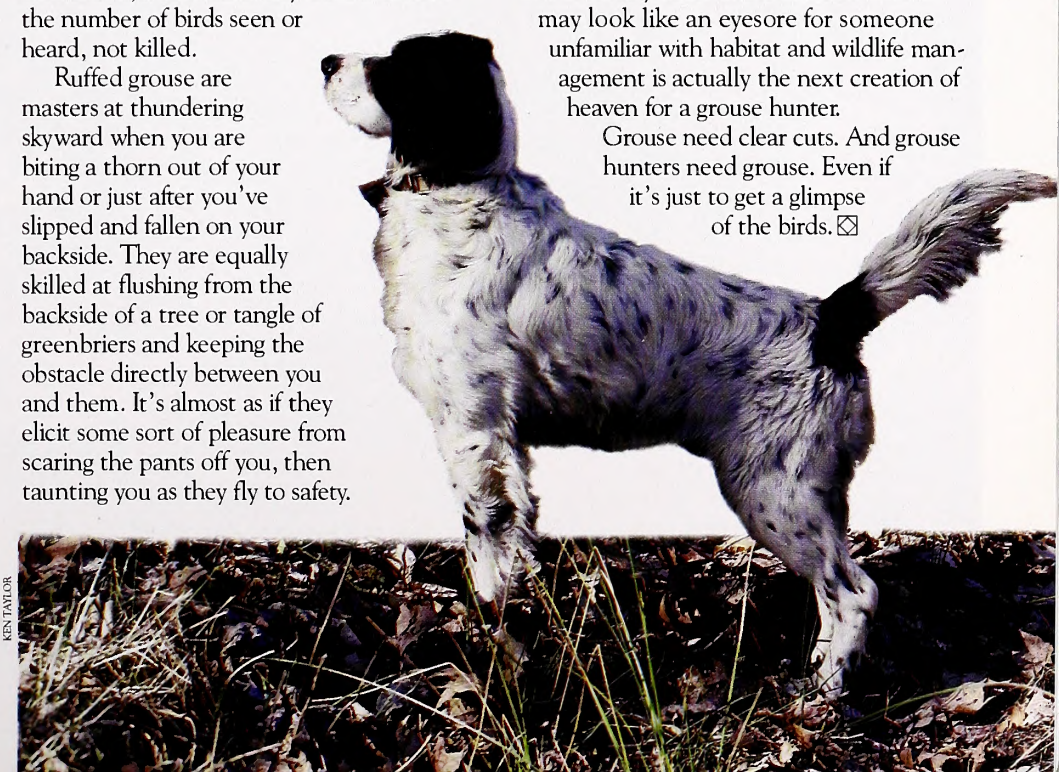
The Future of Grouse Hunting

"Unfortunately, it's become politically incorrect to log on national forestland," said Mike Carraway. "It's gotten to the point where there is little logging activity at all on our public lands. That may be the end of the creation of quality grouse habitat on public land here in North Carolina."

He added that the Ruffed Grouse Society has come up with money to help fund habitat improvement on national forest land but, so far, the Forest Service hasn't done anything with the available money.

Clear cuts may leave an ugly scar on the side of a densely forested mountain, but it usually heals in a short time. What may look like an eyesore for someone unfamiliar with habitat and wildlife management is actually the next creation of heaven for a grouse hunter.

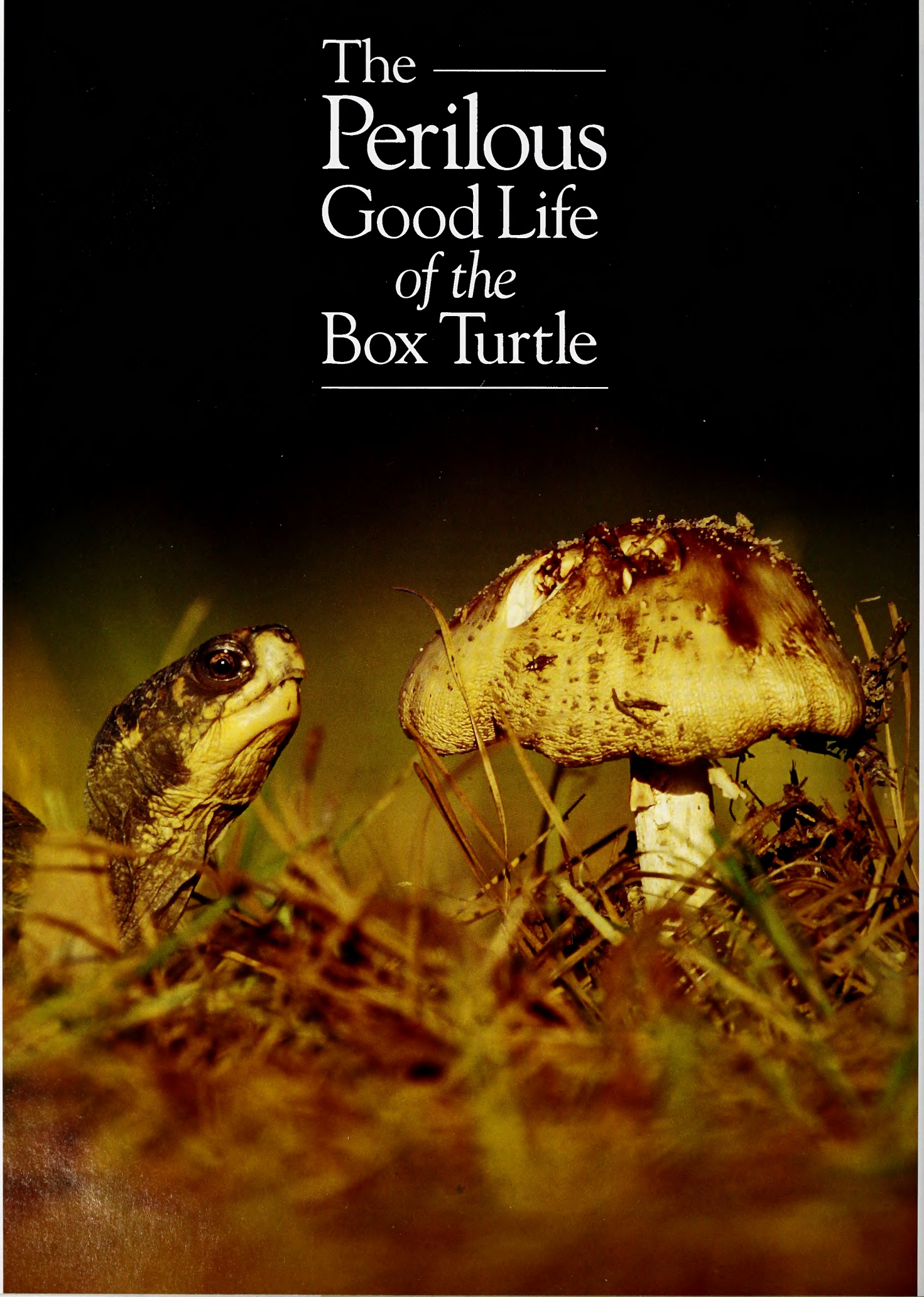
Grouse need clear cuts. And grouse hunters need grouse. Even if it's just to get a glimpse of the birds. ⊠



KEN TAYLOR

***Though not a complete** necessity, a good bird dog is certainly a luxury when grouse hunting. Grouse are masters at thundering skyward at the most inopportune moments. With a dog on point however, shooters can be a little more prepared for the burst of adrenaline that is grouse hunting.*

The Perilous Good Life *of the* Box Turtle



Who wouldn't envy the laid-back lifestyle of the Eastern box turtle? It eats gourmet food, travels in a mobile home and sleeps through the winter. But is the good life enough to protect these vulnerable reptiles?

written by Jim Dean ©1999
photographed by Derrick Hamrick ©1999

***Dining alfresco on** mushrooms and other tidbits (facing page) doesn't mean the box turtle leads a secure existence. Highways that bisect its habitat cause hundreds of turtle deaths each year (above), especially after rains. Box turtle populations may be declining, although the reasons why aren't clear.*

One of my pleasant early memories is of rides along rural paved roads to visit my grandparents in Northampton County. To my parents' frustration, and my delight, there were often box turtles in the road, especially after a summer rain. It was not enough that Dad had to weave around them; there were always a few turtles so perilously situated that he was entreated to pull off the road while I ran back and carried them to safety. Were it left to me, I would have filled the floorboard with rescued turtles, but the line was drawn in that regard after several turtles carried to grandma's garden proved to be poor passengers. They hissed, scrabbled around in their cardboard boxes and usually left ungrateful evidence of a lack of domesticity.

A few of those turtles bore the signs of an earlier encounter with humans. I recall one that had someone's initials painted on its shell. And once, in the swamp field behind Grandma's, I found one that had an astonishingly old date faintly carved in its shell. In more recent years, a box turtle has occasionally appeared in my backyard. I came to recognize it by a distinctive cleft on the rear edge of the shell, the result of an old injury, but I haven't seen it now for some time. Indeed, it has been years since I have encountered box turtles in the numbers I seem to recall from the time when I was a child. I see so few perhaps because I am not traveling those same rural roads as often now, but the reason may be more troubling.

There are at least four subspecies of box turtle (*Terrapene carolina*) found throughout much of the eastern United States. The Eastern box turtle (*Terrapene carolina carolina*) ranges from southern Maine to Georgia and west to Michigan, Illinois and Tennessee, and it is this familiar species that has been adopted by the North Carolina legislature as the State Turtle, joining a list of similarly honored species that includes the cardinal and dogwood. Herpetologists who keep track of such things suspect that the eastern box turtle's population may be declining throughout much of its original range. So far, however, hard evidence remains elusive because there have been so few studies, and pinpointing possible causes is even more speculative.

It is known that box turtles are susceptible to diseases, infections and parasites, but these are natural forms of mortality. And while insecticides and other farm chemicals may be having an impact, there have been no studies that prove a direct link. Almost certainly, the box turtle's greatest problem is adapting to human activities, particularly the loss of favorable woodland habitat to urban sprawl.

Natural predators aren't likely to be a factor. The box turtle has relatively few enemies once it has reached adulthood, because it is well camouflaged and has a stout carapace (upper shell) and a hinged plastron (lower shell) that can be raised like a drawbridge to close off access once the turtle has expelled air and withdrawn its head. Small mammals such as opossums, raccoons and skunks, and some snakes, prey on the eggs and young turtles, and there are more of these predators now, since they have adapted so well to our fragmented landscape (and have no predators themselves). However, David Lee, a curator at the N.C. State Museum of Natural Sciences, believes that only the opossum—and a determined one

Mushrooms, *earthworms, roots, snails and low-growing fruits and berries comprise much of a box turtle's diet, although it will also eat carrion, rabbit young and ground-nesting birds and their eggs.*

at that—has the skills to tackle an adult box turtle successfully. "We don't know exactly how opossums do this, but opossums are probably much better at it than raccoons," says Lee. "A few raccoons apparently learn the trick, but probably not many, and I am not aware of any evidence showing that skunks or other wild mammals can handle an adult box turtle. Certainly, feral dogs and cats—deadly predators for many wild creatures—are no real threat."

But what about wheeled predators? How many times can you cross a well-traveled highway without mishap, especially if your protective instincts (and capabilities) are neither to look first nor to run, but rather to pull in your head and hope for the best? A box turtle unfortunate enough to have its home range bisected by a highway is almost certain to wander into harm's way eventually, and having done so, it is at the mercy of our reflexes and better nature.

The individual box turtle has a home range that can average 5 to 10 acres (occasionally greater). However, the core of that area, where it spends most of its time in random ramblings, may be smaller. Some box turtles range over a much larger area, especially when seeking a mate, and they are known to travel improbable distances at times. Lee recalls that years ago during an exceptionally hot, dry summer, he found a woodland spring where some 200 box turtles had gathered to cool off. How far some had come, how many roads they had crossed and how they knew the whereabouts of the spring are guesswork at best.

Box turtles may face dangers we could scarcely imagine and have yet to assess. Some years ago, while I was walking along a railroad track that flanked a trout stream I had been fishing, I began to find the dried shells of box turtles. Along several hundred yards of track, nearly a dozen turtles had died after apparently crawling through an opening under the rails. Had they been simply trying to cross, or were they seeking warmth on a cool day? Whatever had attracted them, they had become trapped, unable to find the opening that had admitted them. One turtle—the only one I found still alive—clawed feebly at the rails. I carried it into the woods to a wet spot. Was this an isolated tragedy, or have the countless miles of railroad tracks that crisscross our nation been exacting this unmeasured, and perhaps even unknown, toll for nearly two centuries?

Despite such threats, the box turtle does not appear to be in any immediate danger of disappearing, and it is not listed as endangered, threatened or even as a species of special concern. Its ancestors plodded through the Pleistocene and Pliocene, surviving preda-

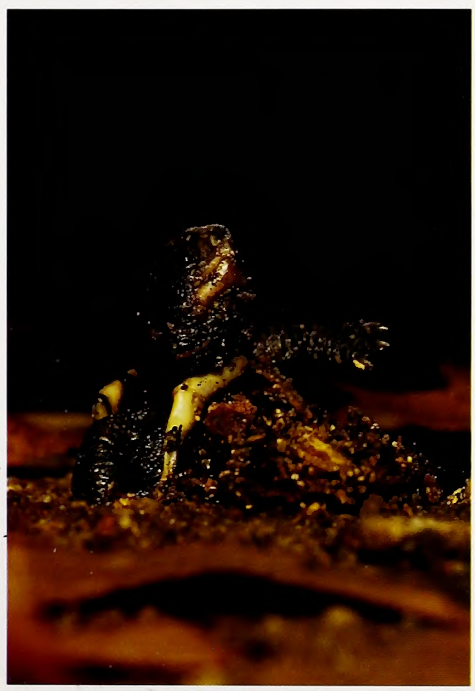
tors that surely were more adept at eating it on the half-shell than is an opossum. Perhaps this remarkable endurance can be traced to its lifestyle—one that seems almost modern.

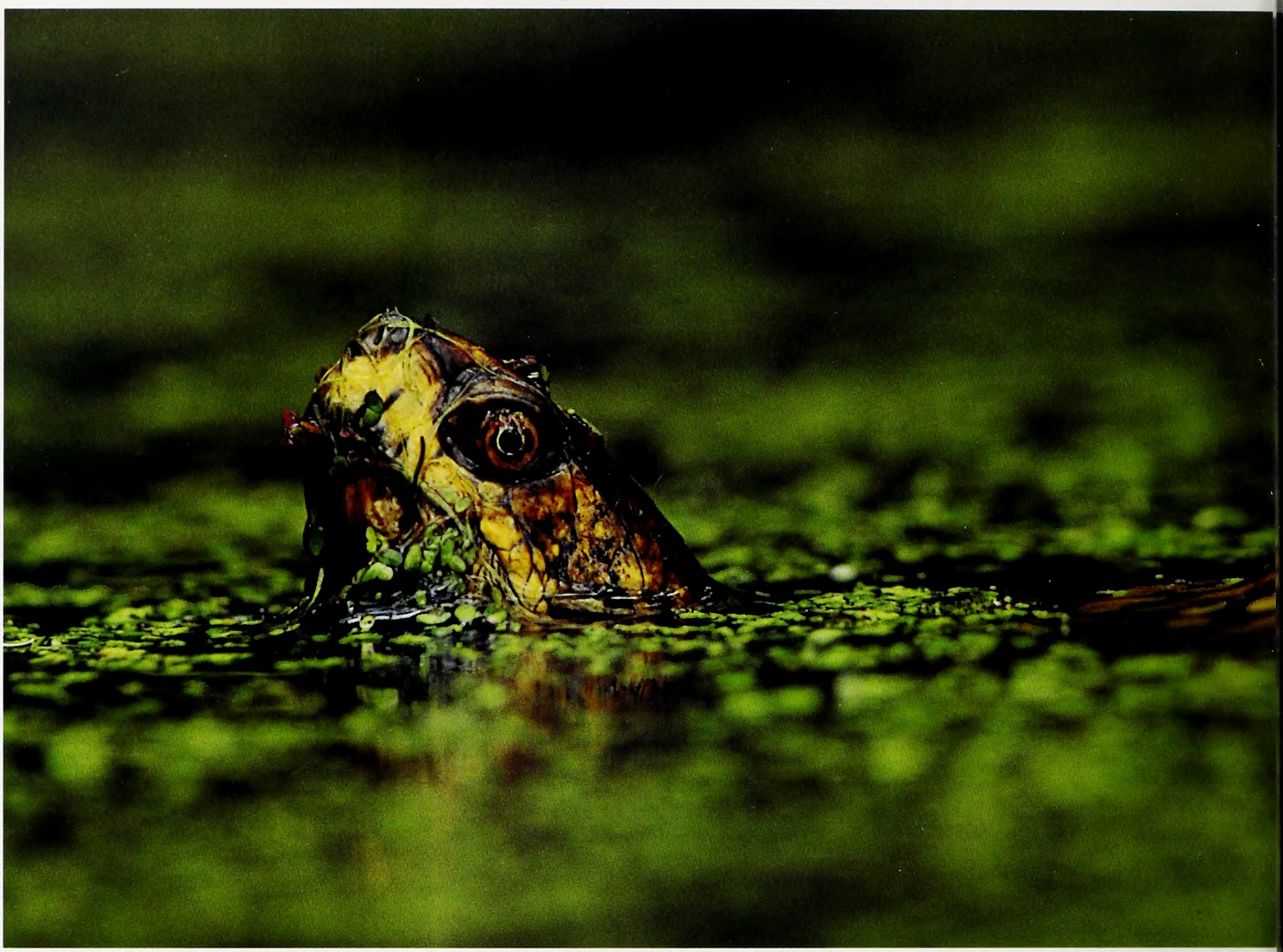
Here, after all, is a creature well adapted for the trendy 1990s. Like an early retiree, the box turtle travels securely in its own mobile home, savoring the delights of the great outdoors. It is a near-perfect generalist when it comes to foods. Like some of us, it has gourmet tastes, preferring escargot (snails and slugs), mushrooms, roots, young leafy plants and stems and low-growing fruits and berries, especially strawberries. A box turtle will also eat worms, insects and carrion and has even been known to eat the young of rabbits or other small mammals, as well as, ground-nesting birds and their eggs. Like many birds and mammals, box turtles serve an important dispersal role for some plants, because the seeds they eat pass through them before they germinate. Mayapples are particularly dependent upon box turtles for this service.

The box turtle is also fashionably something of a loner, spending the warmer months roaming in no particular pattern, taking advantage (after it matures at the age of about 20 years) of the occasional encounter with a member of the opposite sex—showing no enduring loyalty whatever—then moving on to other adventures. Though box turtles tend to remain in their home territories most of the time, the prospect of mating offers the greatest motivation for travel farther abroad. Since mates are not easy to find, male turtles may range as far as 5 to 15 miles while looking. Some never return home, thus transferring genes to other populations, but those who do return apparently use some form of celestial or internal compass (magnetic field) navigation, probably combined with scent clues and visual landmarks. This ability to navigate, combined with an exceptional memory, is also why you will find the same box turtles year after year in your strawberry patch.

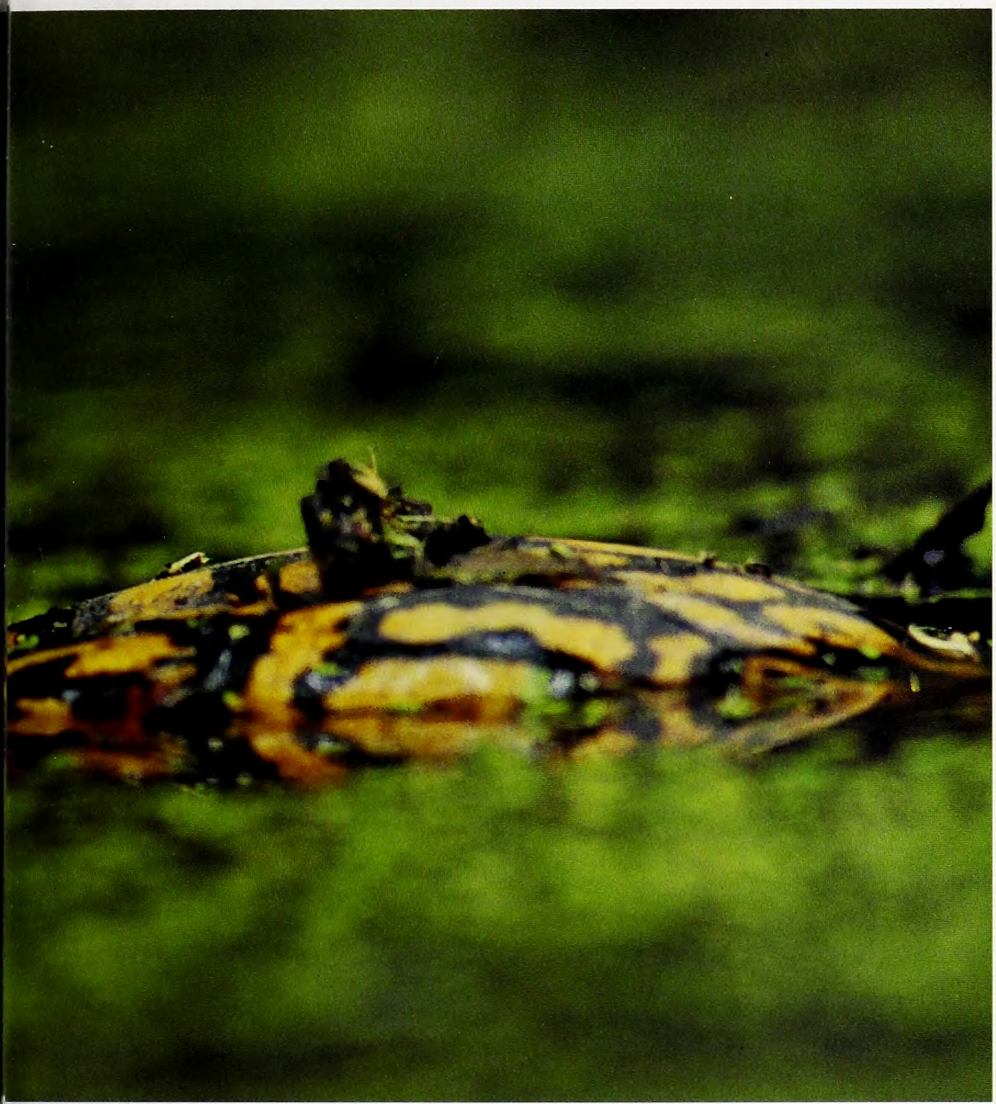
Once fertilized, the female digs a hole and lays her eggs in a warm, sunny spot, often returning year after year to a favorite spot. Since opportunities for mating are haphazard at best, however, she has adapted by storing sperm for up to four years after a mating, fertilizing her eggs as needed prior to laying (her motto: who needs males, except now and then?). Usually, she will lay two to eight eggs that will hatch in about six weeks. The hatchlings must fend for themselves (mom having other interests). The young turtles are small, not much larger than a quarter, and quite vulnerable to predators so they spend their time under dense forest floor litter. There is some evidence that they stay in the nest until spring.

Box turtle mating *(left) is haphazard at best, given the animal's solitary behavior, but the female can store sperm for up to four years after mating. She lays her eggs—usually from three to eight—in June or July (below). Hatching (bottom, left) occurs three months later. This two-day-old box turtle (bottom, right) can barely cover a 50-cent piece.*

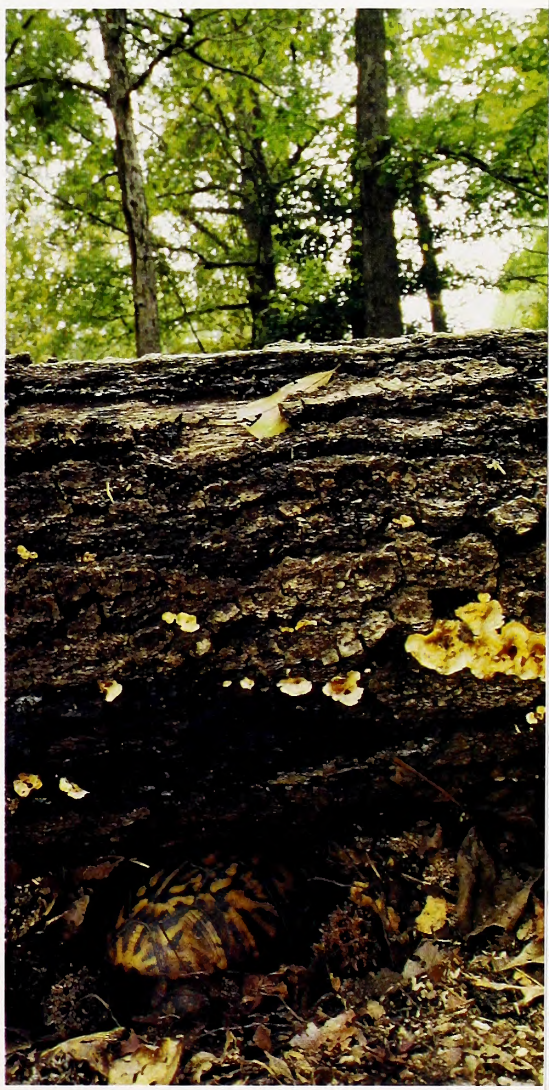




Box turtles disappear *in winter, hibernating beneath as much as 2 feet of soil. They emerge in spring (right) and spend much of their time feeding. As cold-blooded reptiles, box turtles take to water to cool off (above), even decorating themselves now and then with a little duckweed.*



A box turtle's life *span is fairly long—50 years in some cases—despite its slow pace. Few predators have the skills or the patience to overcome the turtle's ability to withdraw head and feet within its stout shell. And when it desires even more privacy it can hide beneath logs (below) or leaf debris.*



"I have found only a few young box turtles, one under a log," said Jeff Beane, curator of herpetology for the N.C. State Museum of Natural Sciences. "Also, they are not always readily identified when they are small because they have much flatter shells, and they don't develop the hinge and plastron until they are a year or so old."

Box turtles have no illusions about the rigors of the off-season. From roughly the time of the first frost, they bury themselves up to 2 feet under soil and leaf litter, where they hibernate until spring. Given such a well-adapted lifestyle, it is not surprising that they also enjoy long lives. It is not unusual for individuals to live 50 years or more, and lifespans in excess of a century have been recorded—the oldest in captivity reportedly survived 138 years.

These characteristics and adaptations are, of course, framed out of eons of evolved instinct; however, these animals are not without intelligence, particularly as regards their celebrated memory. David Lee recalls that when he was a kid, he built a 2½-foot deep cage of chicken wire under his porch and kept box turtles in it.

"Within less than a week, they had learned to climb out," he said. "They'd reach the top, teeter on the edge as if reluctant to make the plunge, then pull in their head and feet and go for it, hitting and rolling. If I put them back, they would wait until they thought I was gone, then begin climbing again."

Lee says that box turtles—indeed, most wild creatures—make very poor pets. In the particular case of box turtles, they tend to dehydrate in captivity and, of course, they are deprived of the means to hibernate properly.

Yet, despite the fact that we may be their worst enemies, there might be one small thing we humans can do to help them. If you see a box turtle in the road or on the edge approaching the pavement, you might be doing it a favor to carry it to the side of the road it was headed for. They may ramble, but they know which way they want to go—for the moment, at least—and they can be remarkably stubborn about it.

Come to think of it, that sounds sort of familiar, too. ⊠

A Green Choice at TAX TIME

Behind a growing Tar Heel land conservation movement, there's an ingenious but little-known financial incentive that just got a lot more powerful. Our wildlife habitats will be the ultimate beneficiaries.

written by Rodney Foushee

Mattie Webber led us on a solemn tour of the remnants of her Mecklenburg County farm this pleasant November morning. It was a tour that spanned generations and represented North Carolina's past, present and future—all on one 109-acre Piedmont farm.

"That's where the old house stood," she said, motioning to the center of the new asphalt road, poured only a few months ago. "There's where the smokehouse was, and the log cabin and the barn."

A group of towering willow oaks, whose seedlings Mattie had helped plant a half-century ago, was all that remained of the homestead. Everything else was razed to make room for the new housing development.

"This was a real farm, a working farm," Mattie insisted, her memories racing back to the days when the smokehouse was loaded with hams and the rolling pastures were filled with cows. She used to wade in the tiny creek—Back Creek—that flowed through the farm. "It was a beautiful farm, one of the most beautiful farms in Mecklenburg County."

But the sounds of circular saws and the annoying warning beeps of a concrete truck in reverse intruded rudely on the memories. Construction workers scurried about laying pipe and framing houses. A bulldozer crept slowly along a few lots away, leveling a building site. The exposed red clay would soon be some proud homeowner's manicured lawn.

Selling the farm was no easy decision. This section of northeastern Mecklenburg County had initially been spared as development pushed southward from the city's heart. But the establishment of the University of North Carolina at Charlotte just a mile away from the farm would eventually bring the city limits just across the barbed wire fence.

Mattie and her husband, Donald, held onto the land until four years ago, when the farm next door was sold and developed. Nine hundred houses were placed on the 200-acre tract. "We knew we had to do something," Mattie said. "We had to do what we thought was best."

Thanks to a relatively obscure tax credit program, the Webbers were able to save at least a quarter of the farm from cul-de-sacs and two-story homes, although they sold the rest of the land for development.

Originally intended to provide more public access to beaches, the North Carolina Conservation Tax Credit was proposed in the early 1980s to give landowners an incentive to donate undeveloped land to the state. But to gain the necessary political support, the coverage of the tax credit was extended beyond the coastal region to land conservation projects across the entire state. Passed by the General Assembly in 1983, the Conservation Tax Credit program has provided a cost-effective incentive to encourage the donation of private land for fish and wildlife conservation, water access and greenways across North Carolina.

The Webbers received a tax credit by donating 27 acres of their farm—the section bordering Back Creek—to the Mecklenburg County Park and Recreation Department. The county has aggressively sought to protect buffers for its creeks and rivers, acquiring more than 2,500 acres in stream borders. Though some of these will be developed into parks and greenways, much of the land, such as the Webbers' donation, will likely be left undisturbed.

As we head slowly down to Back Creek to conclude the tour, the murmur of the creek and the sounds of the trees swaying in the wind block out the noise of construction. Remnants of an oak-hickory forest border the creek. And there on the sandy bank are the fresh tracks of a large white-tailed deer.

Things have not changed much here, except that there are no more cows. Mattie points out the green foliage of a heartleaf plant peeking its way through the fallen oak leaves on the forest floor. "Pull it up," she said. "I always remember it had a strong odor." Her memory is accurate as we pass around the pungent root.

After surveying the woods a bit longer, we pass back through the old barbed-wire fence. Mattie pauses a last time to pluck some late-blooming daisies that managed to survive the morning's frost. "I could always count on picking wildflowers from this land," she remarked as we eased back to the car. "It's nice to have one last chance to walk the old land. It makes me feel good to know that some of the property could be saved," she said. "That some of it will be left for others to enjoy."

On another farm a few hours' drive to the northeast in Orange County, there are still plenty of cows in the pasture. And if Bob and Dorothy Nutter have their way, the cows will always be there.

The Nutters own Maple View Farm, a dairy farm near Hillsborough, where they produce fresh milk and butter. But instead of giving their land away, the Nutters were able to take advantage of the tax credit by putting a perpetual conservation easement on the 100 acres that includes the dairy operation and their home. No matter who owns the land in the future, it must be kept

KEN TAYLOR

MELISSA McGAW

More than 30,000 *acres of land, including tracts along the scenic Lumber River in southeastern North Carolina (above), have been protected from development thanks to the incentive of the N.C. Conservation Tax Credit. The credit is given to private landowners who donate land or easements for conservation such as Mattie and Donald Webber (left), who were able to use the credit to conserve 27 acres of their Mecklenburg County farm.*

in traditional agricultural production.

"It's important to me to protect this land," said Bob, 70, a third-generation dairy farmer. "I like to see the country view," he said pointing to the gentle landscape of pastures and hardwoods. "I didn't want my children to have to look out at a bunch of houses."

Bob also didn't want his children to have to bear the burden of huge estate taxes. With the value of land spiraling out of control in Orange County, as in other places in North Carolina, he decided to contact a local land conservancy, the Triangle Land Conservancy, for help. "The only way the heirs would be able to pay the taxes would be to sell the land," Bob said. But with the easement set up through the conservancy, the value of the land has been reduced substantially because it can't be developed. That means Bob's son and daughter, who help run the farm now, can continue in the tradition of their father for as long as they wish.

The beauty of the Conservation Tax Credit program is its flexibility and the relative ease of the application process, explains Bill Flournoy, the program's administrator for the state Department of Environment and Natural Resources.

As long as a land donation or easement protects fish and wildlife habitat, enhances water quality, preserves the landscape or provides public access, it will likely qualify for the credit. This could include donations of river buffers or easements on private hunting lands.

More than 30,000 acres of land have been protected for conservation thanks to the incentive of the tax credit. Among the growing list of tracts that have been preserved using the credit are several wildlife refuges, including the National Audubon Society's Pine Island Sanctuary in Currituck County, Permuda Island in Pender County and several N.C. Wildlife Resources Commission game lands.

But most private landowners who have claimed the conservation tax credit have donated more modest tracts. Last year, the limits of the credit were raised substantially to encourage more landowners and corporations to donate larger tracts for conservation.

When you mention tax breaks, most people think of the wealthy. "Of course wealthy people are looking for tax breaks," Flournoy said. "But the heart and soul of this program are people who want to save the land."

The tax credit can never equal the monetary value of the property, Flournoy explains. "The credit is just an incentive for landowners who already want to do the right thing," he said. "It just makes the decision to protect the land a little easier."

The Conservation Tax Credit is turning out to be one of the most important tools of the land conservation movement

The Conservation Tax Credit *can be a powerful tool to protect fish and wildlife habitat as well as preserve North Carolina's disappearing rural landscape. Bob Nutter (below) was able to take the credit to preserve 100 acres of his dairy farm in Orange County.*

RODNEY FOUSHEE

in North Carolina (see "Common Ground," July 1998 *Wildlife in North Carolina*). In the flatlands of the Coastal Plain, one local land conservancy has used the tax credit program to help expand a state park, protect a river and indirectly help the waterway receive national recognition.

Originating in the North Carolina Sandhills, the Lumber River extends from the Scotland-Hoke county line and slowly meanders 115 miles downstream to the South Carolina border. This free-flowing blackwater jewel is a haven for fish and wildlife and is home to many rare and endangered plant and animal species. The river's unspoiled scenic beauty makes it a mecca for canoeists, anglers and naturalists.

During the past six years, the Lumber River Conservancy, a local land conservancy based in Lumberton, has worked tirelessly to acquire and protect private tracts along the river in four counties. The efforts of this small group have netted a patchwork of 26 tracts totaling more than 1,200 acres.

Though the individual landowners wanted to preserve the river, the incentive offered by the Conservation Tax Credit helped seal the deals.

"In nearly every case big and small, the Conservation Tax Credit was essential in getting these land donations," said Dickson McLean Jr., a Lumberton attorney who serves as assistant secretary-treasurer for the conservancy. "Without the tax credit, it would have been difficult to obtain these tracts."

Ranging in size from 5 to 240 acres, these parcels are held by the conservancy until they can be transferred to the growing Lumber River State Park. So far, the conservancy has deeded about 400 acres to the park.

Local interest in protecting the river from development, including the grassroots efforts of McLean and many others, helped convince Gov. Jim Hunt in 1996 to petition the U.S. Department of the Interior to designate the Lumber River as a National Wild and Scenic River. Last fall, 81 miles of the river received the lofty designation —only the fourth National Wild and Scenic River in the state.

"I congratulate the state of North Carolina, the city of Lumberton and the town of Fair Bluff in their successful efforts to protect and responsibly manage this magnificent natural resource," said Interior Secretary Bruce Babbitt at a ceremony celebrating the 30th anniversary of the Wild and Scenic Rivers Act. "We look forward to working with the state to help preserve the river's outstanding character in perpetuity."

All great endeavors start with small steps in the right direction. Who can say what 5-acre donation or small tax break makes the difference? ⊠

How the Tax Credit Works

WILLIAMS LEA

***Though landowners** receive a financial break for donating their property for conservation, the wild creatures of our state are the ultimate beneficiaries of the tax credit program.*

Tax credits, unlike tax deductions, are dollar amounts that can be subtracted directly from state taxes owed. In North Carolina, the Conservation Tax Credit is 25 percent of the value of the property or conservation easement.

For example, if you donate land worth $100,000, your tax credit will be $25,000. For conservation easements, the credit is based on how much the value of the land is reduced. If an easement prohibiting the future development of the land reduces its value from $100,000 to $20,000, the easement's value would be $80,000. The tax credit allowed for the easement, 25 percent of the $80,000, would be $20,000.

There are, of course, limits to the state's generosity. The original law set the cap for a tax credit on any single donation at $5,000. That amount was raised to $25,000 in 1989, and in 1997 the General Assembly increased the limit to $100,000 for individuals and $250,000 for corporations. The limit was increased again this year to $250,000 for individuals and $500,000 for corporations. Any excess tax credit can also be carried over and used for five additional years.

To qualify for the Conservation Tax Credit, a landowner must voluntarily transfer some or all of the rights associated with a tract to a government agency or qualified nonprofit group. In a **fee simple interest** transaction, the landowner donates the land outright to the group. The donation of some rights, such as development rights, is called an **easement**.

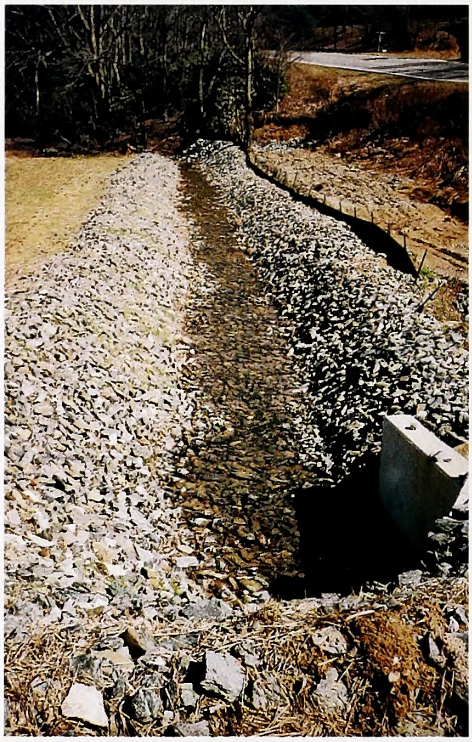
A conservation easement typically restricts the owner from developing the property or destroying natural features but allows him or her to continue to live on, rent or sell the land. The easement, however, is binding on all future purchasers.

A third option is a donation of **remainder interest**, which allows the owner to continue to live on the property until he or she dies, at which time the property is transferred to the nonprofit group or government agency.

Landowners who donate a conservation easement may also benefit from lower property taxes and lower estate taxes. The donor may also claim a federal income tax deduction on the easement.

All applications and final approval for the state Conservation Tax Credit must be certified by the N.C. Department of Environment and Natural Resources before the credit can be claimed on a state tax return. For more information about the tax credit program, contact Bill Flournoy at (919) 715-4191.

Good Roads &



JOE MICKEY

JOE MICKEY

RODNEY FOUSHEE

Both destructive to *trout populations, straight rip rap ditches (top) and culverts (bottom) had been the standard way of handling road construction near streams, until recently. Wildlife Commission biologists are now using highway construction mitigation money to move and reconstruct more natural stream channels, as well as to improve existing trout streams. For example, mitigation funds can be used to fence out cattle on this existing stream (right) to stabilize its banks.*

Good Trout Streams?

When roads are built, trout streams lose. That's the usual formula on the steep grades of western North Carolina, but an innovative program may prove that old wisdom wrong and help restore degraded streams.

written by Micky Clemmons

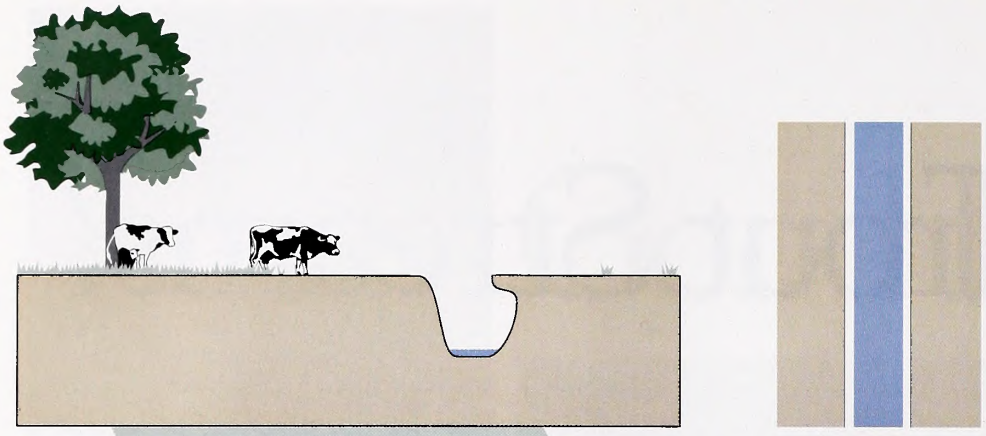
Road construction in western North Carolina has always been a problem for trout and trout anglers. Building a new road can leave streams fouled with loads of sediment from the construction site, and sediment is one of the worst kinds of pollution that fish—and especially trout—can encounter.

For many years, there was not much that trout resource managers with the N.C. Wildlife Resources Commission could do about the problem, except insist the project include stringent erosion controls. In the past year, however, an innovative program is providing Wildlife Commission biologists with one of their most powerful tools for enhancing streams and protecting trout populations. The program joins the N.C. Department of Transportation, the Wildlife Commission and private landowners in an effort that will result in the restoration of miles of damaged trout streams. The program has shown so much potential that other states are already beginning to treat it as a model.

The stream restoration program is a result of regulatory changes made in the early 1990s. Recognizing the importance of trout in the western part of the state, the U.S. Army Corps of Engineers, which

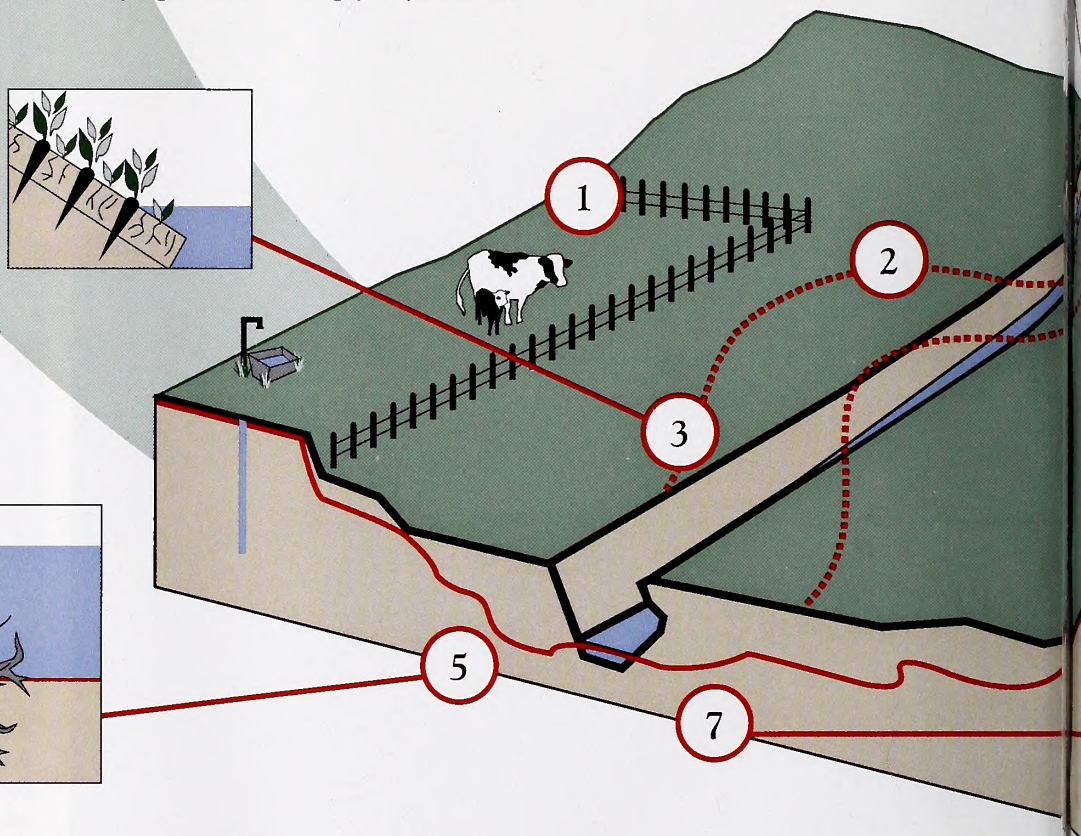
RESTORING A

Crumbling banks pollute streams w
these degraded streams wi



A

Streams are often degraded when *they are confined in straight, deep channels (shown in cross section and aerial views above) and when livestock are allowed access to the stream. This results in banks that erode due to a lack of vegetation and damage from floodwaters.*



GRAPHIC BY ERIN S. HANCOCK

Sources: N.C. Wildlife Resources Commission. Also, *Stream Corridor Restoration: Principles, Processes, and Practices*, U.S. Department of Agriculture (http://www2.hqnet.usda.gov/stream_restoration/).

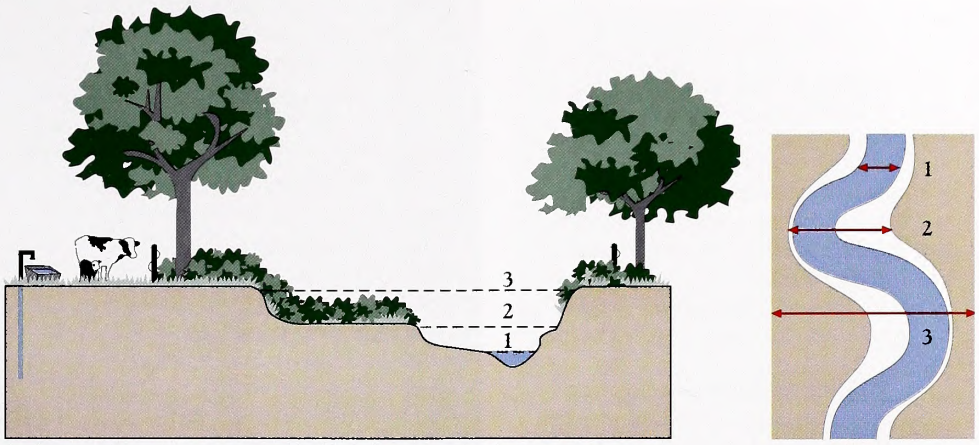
regulates activities in wetlands including streams under the Clean Water Act, established guidelines to protect trout habitat. These guidelines required that all construction permit applications involving trout streams be reviewed by a Wildlife Commission fisheries biologist who would comment on these projects' impacts, such as sedimentation.

Sedimentation is a serious problem for trout because it hinders and even eliminates reproduction. Unlike most North American freshwater fish, trout spawn in the winter. Spawning females look for clean gravel beds in which to lay their eggs. When the female finds a suitable site, she burrows into the gravel to lay her eggs. After they are fertilized by the male, the female fans gravel upstream of the fertilized eggs so the gravel washes down over the eggs and covers them. With this final act the adults leave the eggs to mature over the next two or three months. The fry—juvenile fish—will emerge from the gravel in April.

This reproductive strategy has advantages and disadvantages. The early spawning time is advantageous because there are fewer predators to feed on the eggs. It is a disadvantage because the eggs mature very slowly in the cold water and must remain in the gravel for an extended period of time. If sediment covers the eggs during development, they will suffocate because of a lack of oxygen. In a case of extreme siltation, all of the eggs in a stream may die. Since trout in North Carolina have a relatively short life, a chronic sedimentation problem that lasts three or four years could wipe out the trout population of a stream.

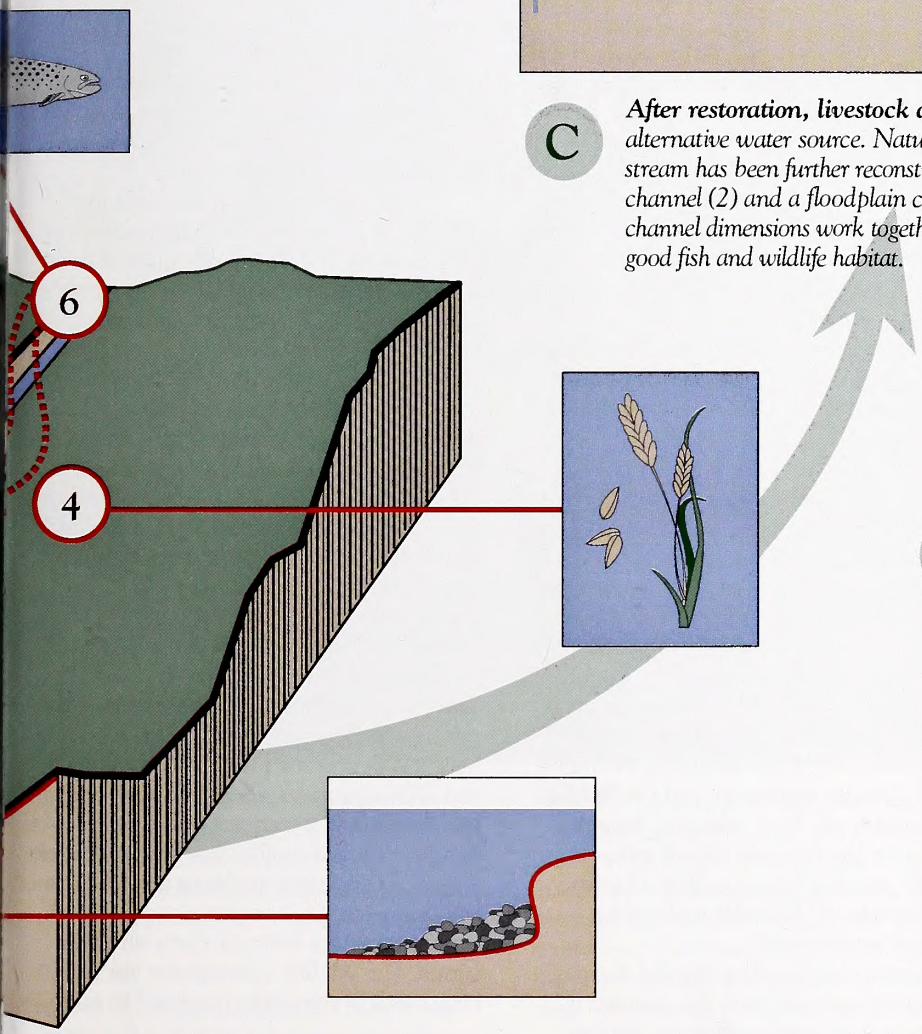
ROUT STREAM

diment, but biologists can restore e innovative techniques.



C

After restoration, livestock are excluded *from the stream and provided with an alternative water source. Natural stream meanders have been reintroduced and the stream has been further reconstructed to provide a low-water channel (1), a bankfull channel (2) and a floodplain channel (3), each at increasing width and depth. These channel dimensions work together to reduce the energy of high water while providing good fish and wildlife habitat.*



B

The restoration of a *degraded stream involves several steps, including: 1) Restricting livestock from the stream and vegetated riparian areas. 2) Reintroducing stream meanders across the valley floor, which reduces the water's energy and the amount of erosion. 3) Planting woody vegetation to provide a root mass to stabilize the bank and foliage to shade the stream. 4) Growing native vegetation to stabilize the banks. 5) Using root wads to stabilize the outside of meanders while at the same time providing excellent fish habitat. 6) Stocking trout will also repopulate the new reach by moving from other areas. 7) Proper channel dimensions and improved streamside vegetation result in clean gravel necessary for trout spawning.*

In 1996, the Corps requested that the Wildlife Commission review the proposed construction of 10 new miles of U.S. 23, from Mars Hill to Sam's Gap at the North Carolina/Tennessee line. When completed, this new road would be designated as the continuation of Interstate 26, which presently ends at Asheville.

During their review of the project, biologists made fairly standard recommendations: avoid impacts to game animals like deer and bear; strictly adhere to erosion-control practices; keep wet concrete out of streams (it kills fish); and avoid work in streams during the winter months when eggs are in the gravel. However, the large size of this project posed some extraordinary problems. Indeed, more than two miles of streams near the highway would have to be placed in long culverts.

Streams placed in culverts—underground piping—are considered lost from a biological and recreational standpoint. The lack of light eliminates plant growth, limits the number of animals the stream can support, and hinders the ability of fish living in our cold-water streams to find food. Long culverts on creeks also block fish movement. A long, steep, flat-bottomed pipe is a difficult structure for a fish to swim through because of the thin layer of water and its high velocity. And to anglers, a stream in a pipe is not desirable because it can no longer support fishing or other types of recreation.

Because these streams would be lost during road construction, the agencies sought an innovative way to mitigate, or compensate, the public for this loss. They decided to mitigate the loss by restoring degraded trout streams elsewhere in the watershed.

***Wildlife biologists** recently used mitigation money to relocate a section of Bear Branch in Madison County. Starting with the top picture, the series below shows the creation of the diverted portion of Bear Branch during a 12-month period. After a year (bottom), vegetation had returned to the site, and with it insects and trout.*

MICKY CLEMMONS

MICKY CLEMMONS

CHRIS POWELL

Stream restoration is not easy. A fully restored stream must function similarly to a natural, stable stream by moving water off the land, reducing the energy of the water flow (so that it causes minimal bank erosion) and supporting a diversity of aquatic animals. Wildlife Commission personnel were experienced in restoring streams, so the Department of Transportation asked them to consider carrying out restoration activities for mitigation. The Corps approved the mitigation and made its implementation a condition of the Department of Transportation's permit to build the road. The Corps also stipulated that mitigation would be at a ratio of 2-to-1, meaning that for every foot of stream lost to the road project, 2 feet of stream would be restored or enhanced outside of the construction area.

In 1997, the Department of Transportation and the Wildlife Commission entered into an agreement to restore 26,000 linear feet of stream in Madison County, where the impacts from the I-26 project were occurring. The DOT agreed to pay the Wildlife Commission $50 per linear foot of stream to be restored, establishing a fund of $1.3 million to be used to enhance or restore trout streams.

The DOT is responsible for acquiring mitigation sites with the active participation of the Wildlife Commission. Mitigation sites can be purchased or acquired through a conservation easement agreement, which basically prevents the area from further disturbance. The Commission is responsible for developing and carrying out restoration plans for each site within three years of obtaining the last mitigation site. The DOT will maintain the restoration sites for five years following completion, and the Wildlife Commission will then take over maintenance after the five-year period and continue for another 10 years. After 15 years, these sites should be stable and require very little maintenance.

Because many of the impacted streams flow through private land, the program is directed toward private property owners. Many of these streams have been placed in straight ditches, their woody vegetation has been cleared, or their banks have been eroded because of livestock grazing. These streams are prime candidates for the stream restoration program. Landowners having these types of problems can apply to the restoration program for help (see "How to Apply").

Don Fosson's farm on Paint Fork Creek in Madison County provides a good example of what the program can do. Fosson's property borders approximately 1,000 feet of Paint Fork Creek and a small tributary. The stream has some trees along the riparian zone, though the vegetation in this area is primarily made up of shallow-rooted herbaceous plants. Woody vegetation is preferred because it roots deeply and holds the bank. The stream also has a berm along one side that keeps the water confined to the channel during high water. This has caused the stream to erode the bank opposite the berm so that it is primarily vertical.

The site plan involves removing the berm, building a flood plain and sloping the banks. Both banks will then be planted with various species of native trees to anchor the banks in place. A 30-foot riparian zone is being set aside in a permanent conservation easement. A fence will be constructed to separate the stream and riparian zone from the adjoining field. The mitigation program is a good way to put to use land not needed for farming, Fosson said.

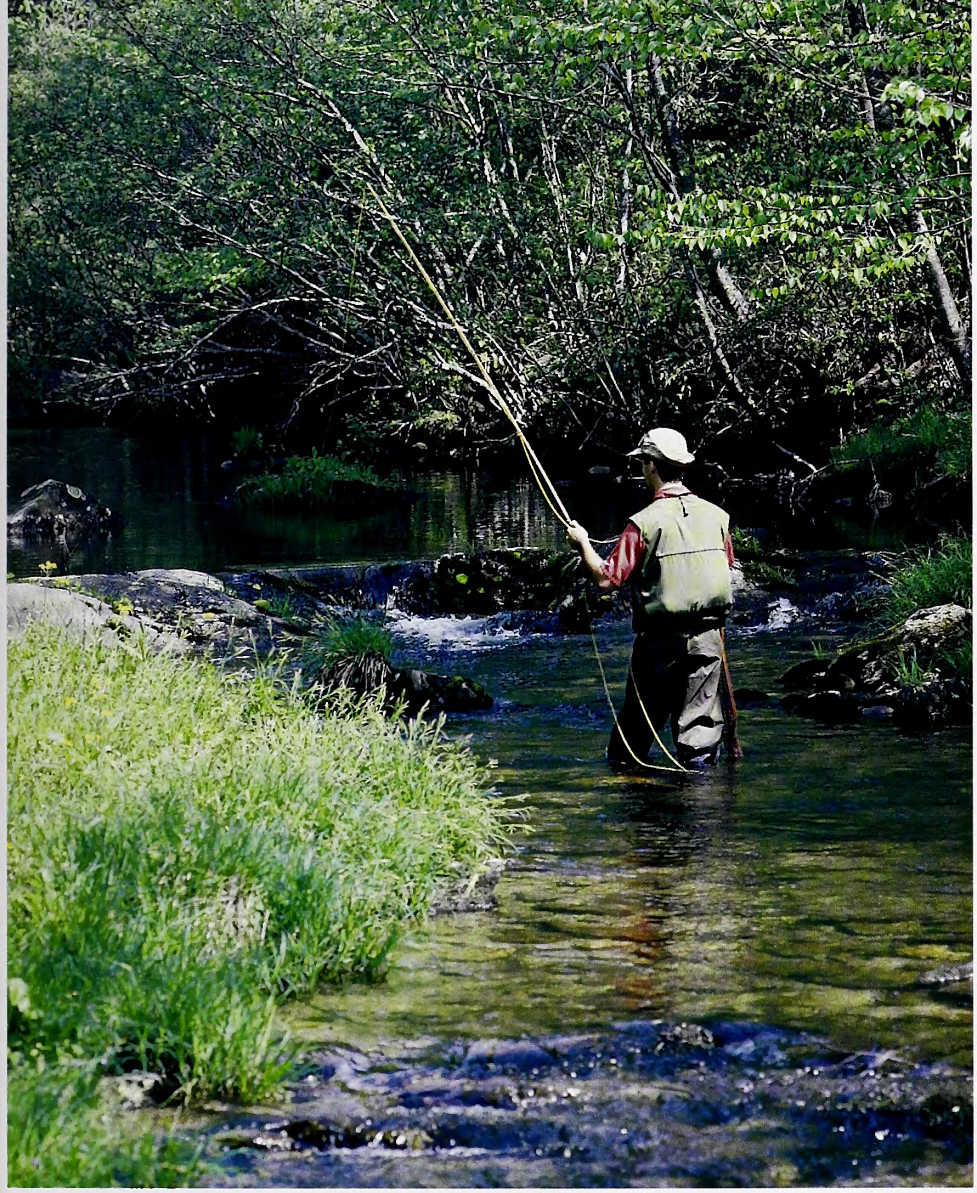
"A 30-foot easement is fine with me," Fosson said. "I can't farm that area anyway because it has flooded so often that it does not grow good tobacco. I would rather let it grow up to stabilize the creek bank and provide habitat for wildlife."

Mitigation of unavoidable highway impacts to streams through this program is just beginning. Mitigation programs are presently being conducted in Madison, Watauga, Wilkes and Buncombe counties. The Corps requires the DOT to conduct restoration activities on 57,942 feet of stream in these four counties. Easement agreements are presently being developed with four landowners in Madison County, and work at these sites is planned for this spring. Additional applications are being accepted, and work with other Madison County landowners will begin soon. We have just begun the programs in Watauga and Wilkes counties where U.S. 421 is being four-laned, and a contract with the DOT for mitigation in Buncombe County was recently signed. Applications are being received from landowners in these counties and plans will be developed for many of these sites this winter. The Wildlife Commission wants to have much of the work completed by fall.

Moving stream channels, rather than piping and covering them, is also being practiced now. During the last year, such channel changes were conducted on four streams. One of them is Bear Branch in Madison County.

Road engineers had proposed to pipe or move Bear Branch to make way for an access road to the interstate. The stream was fairly small, about 4-feet wide, and approximately 500 feet of the stream was in the way of the road fill. Wildlife Commission personnel were asked to help design and construct a new channel for Bear Branch.

They began by measuring the dimension pattern and profile (width, depth, meander



JIM DEAN

***Thanks to a new** cooperative spirit between the N.C. Wildlife Resources Commission and the N.C. Department of Transportation, anglers should have better road trips to good trout streams.*

etc.) of the original channel. Once it was determined what the channel needed to look like, road builders dug a new floodplain and a channel that would accommodate high- and low-water levels. Natural materials such as rootwads (toppled trees with exposed roots) and boulders were used to stabilize the bank bends. Other natural features such as riffles and pools and a cobble substrate were added. The area was then seeded with a mixture that included a number of native plant species, and trees were planted throughout the area.

Before water was diverted into the new channel, about 160 rainbow trout ranging in size from 2 inches to 14 inches were removed from the old stream and placed in the Laurel River. Within one year, trout moved up naturally to the new stream. With vegetation now covering the bare soil, the stream has begun to look completely natural. Aquatic insects moved downstream and took up residence in the new reach. Gradually, terrestrial invertebrates, such as grasshoppers, occupied the new vegetated stream bank, and planted trees will grow, providing wildlife habitat.

To top it all off, the restoration process was relatively inexpensive. All of the work to build this channel cost less than $25,000—a significant savings when compared to one estimate of $600,000.

In the past, Department of Transportation and Wildlife Commission objectives have sometimes clashed over projects that required the loss of wildlife habitat. But with the spirit of cooperation that now exists between the two agencies, North Carolinians and their fish and wildlife are benefiting with good roadways, high-quality habitat and improved water quality. ⊠

Micky Clemmons is the stream mitigation coordinator for the N.C. Wildlife Resources Commission.

How to Apply

Project applications are ranked in priority based on the potential to improve the existing habitat and water quality with restoration funds. When a site is chosen for restoration, several things happen: A Wildlife Commission fisheries biologist and Natural Resources Conservation Service agent visit the landowner, evaluate the site and develop a conceptual mitigation plan. Proposals can include fencing livestock out of the creek, constructing watering facilities as an alternative to using the stream, restoring the riparian zone to a stable condition through shaping the stream bank, planting riparian vegetation, improving fish habitat within the stream and restoring a stable shape and profile to the stream.

Most landowners who apply to the program prefer placing the stream and its riparian zone in a conservation easement rather than selling the land. When the conceptual plan is developed, the area to which the conservation easement will apply is marked. The easement boundaries are discussed with a landowner and adjustments made. At this point, the landowner can either decide to continue with the program and the drafting of the easement or withdraw from it. The mitigation program pays for all restoration activities, so there are no costs to the landowner.

When a landowner accepts the plan, the next step is to develop a conservation easement agreement for their property. This involves surveying the easement area for an accurate measure of the acreage. The area is then used to determine a fair-market price that the Department of Transportation will pay for the easement. The conservation easement is a legal document written for each site that defines the conditions agreed to by the agencies and the landowner. The primary responsibility of the landowner is to maintain the easement area in a natural state, not allowing grazing or destruction of native vegetation in the area. This document, the survey and the price to be paid for the easement are developed by the Department of Transportation and presented to the landowner for approval. Once signed, the agreement will be attached to the property in perpetuity.

For information about how to apply for this program, contact Micky Clemmons, stream mitigation coordinator, at (828) 452-6191; or E-mail: clemmomm@mail.wildlife.state.nc.us.

Heddon

The Reel That Resurrected Bait Casting

The Ambassadeur 5000 turned a few heads when it arrived on these shores more than 40 years ago. Odds are that a lot of senior plug chunkers still harbor a couple of these legendary reels in their treasure chests.

written by Mike Gaddis ©1999

It was the spring of 1962. Outside, the sun was laying grace over another gorgeous Carolina morning. The red-winged blackbirds were nesting in the cattails anew, and the bass were jumping anything that twitched.

There I sat, however, nailed to a seat in a classroom at North Carolina State University, assailed by Professor Bill Touissant's discourse on supply-side economics. Matriculation, I was thinking, was just as bad as it sounds.

I scrutinized my angling cohort Bill Williams in the next aisle, expecting a glassy stare. To my surprise, he was wide awake, hunched over his desktop, and clearly into something clandestine. He had a three-ring binder propped up with a pencil, shielding himself from professorial surveillance, and he was fondling a small, brown leather case with an intriguing gold seal. Grinning impishly, he threw me a goody-two-shoes glance, then opened the little case and flashed its contents at me.

Inside was...a reel, a baitcasting reel to be exact, unlike any I had seen before. All shiny, metallic red.

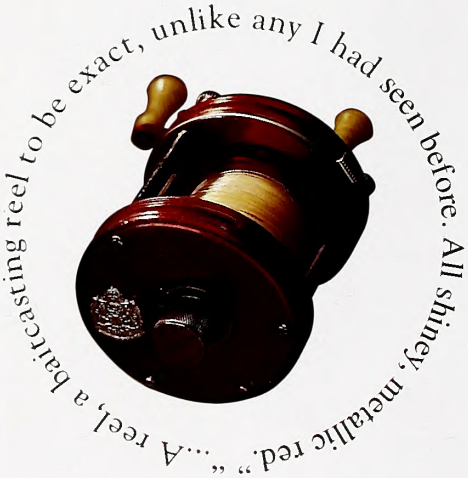
Bill slipped me the small service manual. The header read "Garcia Abu Ambassadeur," followed by an image of the reel. The pitch line boldly declared it: "Fit for a King." There was a royal seal, white with a red crest. Beneath the seal was a proclamation: "Purveyor to H.M. the King of Sweden." The air of distinction was unequivocal.

It was my first brush with the Ambassadeur 5000, which was destined to become one of the most beloved and revolutionary products in angling history.

Bill had just acquired it as new stock from Thorne's, the late, venerable sporting goods establishment that once sat near the corner of South and West streets in Old Raleigh. After class I wrested it away for a few minutes. From the moment I touched the mirror-bright, anodized finish, tripped the free-spool button, felt the buttery smooth peel of the line from the arbor, I was captivated. I had to have one, as it seemed did every other bass fisherman in America.

Actually, the Garcia Abu Ambassadeur 5000 debuted in the United States at the New York World's Fair in 1954, becoming available in the public market shortly afterward. It trickled onto North Carolina sporting goods shelves, however, along with Creme worms and Lowrance Fish Lo-K-Tors, about 1961. The timing was fortuitous; by the late '60s, sales for all three products had soared, each contributing strongly to the others' successes.

"Abu was a Swedish precision engineering company building clocks, fine pocket watches, and small instruments," relates Jim McIntosh, product innovation manager for baitcasting reels at Outdoor Technologies,



Inc. (Garcia). "The factory, located on the Mörrum River, was operated by the Borgstrom family. The Mörrum was a fabled salmon fishery, and Mr. Borgstrom loved to fish for salmon.

"He started tinkering with high-quality baitcasting reels in the forties and came up with the Record 2100, which was a very fine reel in its own right. Borgstrom started selling a few, got into reels full tilt, and by 1952 the 5000 had evolved."

The Ambassadeur 5000 was one of the earliest baitcasting reels to combine a synchronized level-wind mechanism with a conveniently activated free-spool mechanism, and also one of the foremost reels to transport a star drag into a freshwater application. Nylon gears and self-centering spool bushings assured ultra-smooth and trouble-free performance, light years beyond the best conventional J.A. Coxe or Pfleuger Supreme. A centrifugal brake utilizing balanced brake blocks of varying sizes, with a mechanical backup, admirably tamed backlash and enabled individual tuning to line size, lure weight, rod action and personal casting technique. A quick turn of three knurled screws exposed the internal works for cleaning.

Eminently eye-catching, with its racy, anodized red housing, chrome frame and double-knob pearl handles, it was almost tawdry, but it had sophistication and class. Its size was a boon also. It was a power reel, with a manly heft.

It came in a custom leather case, as distinctive as the reel itself, with a small service kit. The kit sported a small combo wrench and screwdriver, a vial of fine oil with a glass applicator, a series of centrifugal blocks, a spare handle nut, and the tiny lock washers and screws one might misplace or lose during cleaning disassembly.

"It [the 5000] bespoke quality and here-and-now technology," remarks McIntosh, "and through the marketing genius of Thomas Link at Garcia, it ascended royally."

Largemouth fishermen played a major role in that ascension. By the early 1960s, bass fishermen were deeply entangled in a love-hate affair with spinning and spin-cast tackle. Surfing the crest of its popularity following World War II, spinning gear had relegated baitcasting, the perennial bass-ing stand-by, to the bottom of the national tackle box. There were a host of effective lures on the market in the 1/8- to 3/8-ounce range, like the Finnish Rapala and Heddon Baby Torpedo. But throwing them on even the best of the old straight-drive baitcasters was the next thing to spittin' in the wind. Plus, plastic worms were new on the scene and hot as a Mexican peppercorn. You could launch them all quite nicely on a spinning rig, of course, but getting them back was the problem. What monster bass did to spinning tackle and fairy lines in heavy cover was a very ugly thing.

The 5000 was the equalizer, restoring accuracy, control and persuasion to fishing, especially to fishing with plastic worms.

In our early field tests, we'd team it with a Heddon Brute Stick, 20-pound Stren, and a Bagley's OL' Monster firetail on an Eagle Claw No. 249 Weedmaster hook. Mashing on a couple of No. 4 split-shot, we'd fearlessly sling the great worm into the worst thing the old Wake County mill ponds—Sunset, Panther, Bass, Cattail and Myra—could muster.

Bill flipped his into Myra one day, alongside an ancient, black log studded with protruding limbs and guarded by a dense regiment of lily pads. Before it settled, a slab-sided bruiser sucked it up and swaggered off like the playground bully who's just snatched your girlfriend's hat. Certain, I imagine, that we were teasing him with a Mitchell 300, the fish rared into Bill, Bill rared into the fish, and the star drag of the 5000 kicked in, aided by a measured thumb. The shadow-green hulk of a bass churned surface water the length of the log trying to reach the tough stems and sayonara of the lily pad bed, finally rearing and thrashing a massive head in a water-shattering, bulldog effort to shake the hook. The stubborn Ambassadeur and stiff blank rolled it much as a roping horse upends a rodeo calf. Moments later, Bill lipped the pot-bellied 9-pounder and heaved it over the gunwale onto the floor of the old copper-bottom bateau. The fish lay in a ponderous mound, its great gill plates heaving sporadically.

Bill and I studied the fish for a few seconds, then each other. Suddenly, we broke into devilish laughter. Our jubilation echoed that of a million other bass aficionados the nation over. Largemouths could take warning!

Slip in a spare spool, and the 5000 could finesse the small stuff, too. Its accommodation of light monofilaments and almost frictionless spooling made delivery of light lures and unweighted plastics, even Doc Walker's hot little green 4-inch "do-nothin'" worms, as easy as the snap of your wrist. And if you really wanted a taste of angling heaven, you could mate it to a 6-foot Heddon Mark IV rod and a classic old-timer like a 5/8-ounce Creek Chub Pikie or Heddon S.O.S. and shave the whiskers off a gnat at 50 feet. Bass addicts embraced it like a prodigal lover, and I'll lay odds every gray-templed largemouth chunker in North Carolina still harbors one or two in his treasure chest.

In 1962, the Ambassadeur 5000 retailed at around $50, a stiff piece of change in those days. My friend Sammy Giddens and I were in a small fishing club, and to the last man,

JIM DEAN

***Known for its smooth** cast and trouble-free performance, the Abu 5000 quickly developed a legion of devout followers after its introduction four decades ago. Matched with the proper tackle, the stout baitcasting reel proved deadly for largemouth bass.*

the 5000 was an aspiration. Sammy was a newly commissioned barber, struggling to make financial ends meet. Fifty bucks was half a paycheck some weeks. Moreover, he was a Sampson County farm boy, accustomed to hardscrabble frugality. "We was poor," he used to tell me. "The only difference between us and the migrant workers was...they got to travel."

Sammy scrimped and saved for months until he finally pinched together enough for a 5000, along with a new Heddon Pal Mark Series rod. The very next day, we fished Buggs Island Lake. In the heat of a bass frenzy, Sammy powered off a cast, and the lure momentarily hung the gunnel. The force of the arrested motion whipped the new rig neatly out of his hands and into the maw of Nutbush Creek. Without a thought, he piled in after it. Too late.

"It's still the sickest feeling I've ever had," he told me recently.

In 1963, the rising celebrity of the 5000 quickly spurred Garcia to market a collector's version, the 5000DL, in gleaming midnight black accented with 24-carat gold plate, presented in a handcrafted teak case bearing the Abu insignia. I don't know how many were sold, but even at a hundred bucks, it was a burning temptation.

Far ahead of its time, the Ambassadeur 5000 launched a blitzkrieg for Abu/Garcia. It had few serious competitors in its day, though it prompted a retaliatory spurt of period freespools from old guard manufacturers. Heddon countered with the Heritage, also originating from Sweden, possibly even from Abu; Shakespeare responded with a retooled version of its top-of-the-line President; and Pfleuger rapidly fielded a free-spin edition of its revered Supreme. All were respectable reels, but none did significant damage to the 5000's market dominance. Almost as soon as they hit sales counters, Abu was launching the 5000B, with a single-knob, counter balanced handle, and shortly afterward, in 1966-1967, the 5000C. With its rich black shell reminiscent of the lavish 5000DL, the 5000C spooled on stainless-steel ball bearings, a significant improvement over the simple bronze footings of the 5000. The result: notably smoother and more durable casting performance. It was another jewel in the Swedish crown.

By the '70s, the Ambassadeur 5000s were as ubiquitous as grilled cheese sandwiches. At the 1971 North Carolina Bass Championship on Lake Norman, the state's first major largemouth tournament, the 5000 was easily the reel of choice for more than 90 percent of the competitors. Nationally, its immense popularity supported a plethora of cottage industries, picking up where Abu left off. "Quick-Draw" rod holsters molded to Ambassadeur fit, oversized "power" handles and Teflon bearing replacements were a few of their many offerings.

Even today, the legendary 5000, with four decades of refinement, remains a popular model in the Abu/Garcia line, and since its introduction, more than 20 million Ambassadeur reels have been purchased by appreciative anglers world-wide.

Almost a century and a half after Snyder, Meek and Milam crafted the first of the Kentucky watchmaker reels, baitcasting rides an all-time popularity high, more enjoyable, versatile and effective than ever before. For 30 years, bass anglers—professionals and dedicated amateurs alike—have profited from a burgeoning of baitcasting reel manufacturers, accelerating competition and cyber-age technological advancements. The latest ultrasmooth, machined aluminum super-reels by Shimano, Daiwa, Pinnacle, Shakespeare, Quantum, Lew's, Pfleuger and, of course, Abu Garcia, are the best the world has ever put over the water.

Credit the old Abu 5000, the reel that resurrected baitcasting. ⊠

One of the most powerful books ever written about the environment was published 50 years ago. The man who wrote A Sand County Almanac *learned his love of nature as a boy. The boy who became that man was*

Young Aldo Leopold

written by Julie Dunlap / illustrated by Consie Powell

ALDO LEOPOLD FOUNDATION ARCHIVES

Almanacs are usually yearbooks, month-to month guides following weather, tides and other seasonal events. But when Aldo Leopold wrote *A Sand County Almanac* he had something different in mind. He wanted readers to use his almanac as a guide to living close to nature, as part of the natural world.

Born Jan. 11, 1887, Aldo Leopold began discovering nature as a boy in Burlington, Iowa. Winters brought snowball fights with his brothers and ice skating on the Mississippi River with his mother and sister. Some spring mornings Aldo skipped school to tramp along the river bluffs. And on summer picnics, Aldo's father led the children on hikes. Carl Leopold might knock on a hollow log and ask, "What animal lives here?" Or he'd point out some **scat** and say, "Who ate crayfish for dinner?" Aldo puzzled over every question, determined to read the woods as well as his father did.

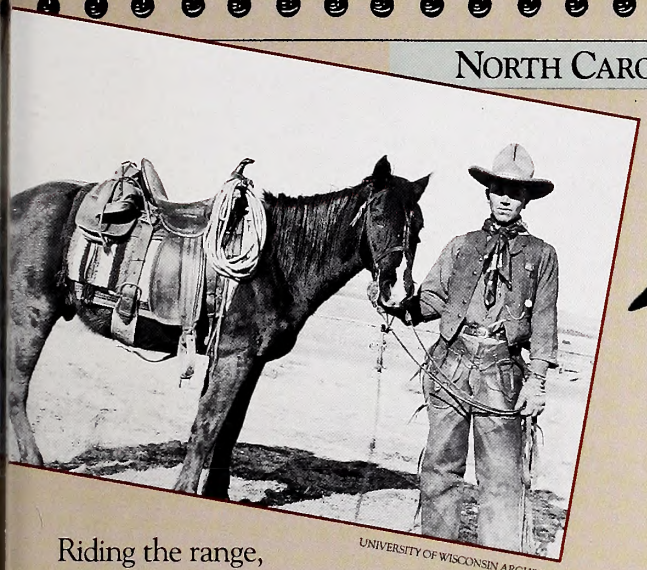
Fall brought the year's highlight: hunting season. Carl Leopold woke his son in the dark. They breakfasted on beans, whistled for the dogs, and headed for a Mississippi marsh. On his first hunts, Aldo shouldered a stick instead of a gun. When he proved he could handle it carefully, his father awarded the 11-year-old with his first shotgun.

Few laws protected **waterfowl** in the 1800s, and some hunters killed ducks by the wagon load. Carl Leopold, though, set his own hunting rules. He never baited birds. He stopped hunting in spring. He only shot as much as his family could eat. Aldo admired his father for taking personal responsibility and vowed likewise to protect waterfowl "when my turn comes to have something to say...."

"Acts of creation are ordinarily reserved for gods and poets, but humbler folk may circumvent this restriction if they know how. To plant a pine, for example, one need be neither god nor poet; one need only own a shovel. By virtue of this curious loophole in the rules, any clodhopper may say: Let there be a tree—and there will be one."

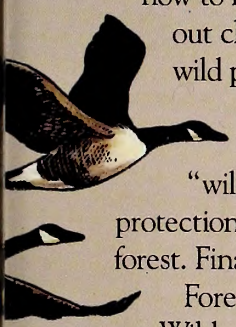
—A Sand County Almanac

Forests were another shrinking **natural resource** that troubled the Leopolds. The U.S. Forest Service was created in 1905 to manage forest use. Working in the woods as a **forester** sounded like the perfect job to Aldo Leopold. In 1909, fresh from the Yale Forest School, Leopold took his first job in Arizona's Apache National Forest. He bought a 10-gallon hat, then rode off to inventory the mountain forest. At first, he didn't pack enough food for his crew. He even got lost. Smarting from his mistakes, Leopold still liked the rough work and soon was an old hand.



UNIVERSITY OF WISCONSIN ARCHIVES

Riding the range, Leopold noticed that pronghorn antelope, deer and other wildlife were growing scarce. He urged hunters to form game protection societies and to support strict hunting laws. But erosion, mud-clogged streams, and other scars on the land told Leopold: people did not yet know how to log and graze the land without changing it. Everyone needs wild places undamaged by human use, Leopold believed. He talked and wrote about his "wilderness idea," calling for protection of a remote New Mexico forest. Finally, on June 3, 1924, the Forest Service created the Gila Wilderness Area.



A Forest Service laboratory job took Leopold, his wife, Estella, and children to Madison, Wisconsin. Leopold soon resigned to study **game** birds, looking for ways landowners could improve their property to help birds. In 1933, the University of Wisconsin hired him as the nation's first professor of game management. Leopold happily led student field trips, asking question after question. One student remembers, "He'd stretch your brains until they were tired."

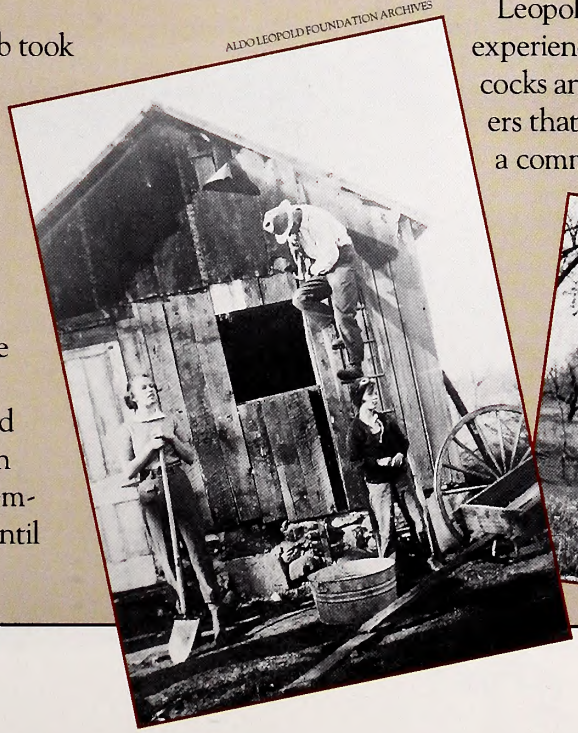
"That whimsical fellow called Evolution, having enlarged the dinosaur until he tripped over his own toes, tried shrinking the chickadee until he was just too big to be snapped up by flycatchers as an insect, and just too little to be pursued by hawks and owls as meat. Then he regarded his handiwork and laughed. Everyone laughs at so small a bundle of large enthusiasms."
—A Sand County Almanac

In 1935, Leopold led his family into a blizzard. He could hardly wait to show them their new farm. His shivering wife and five children were shocked by what they saw. Wind rattled weeds in an overgrown cornfield. Tree stumps poked through snow on hills once stripped for lumber. The only shelter was a sagging chicken coop. The 80-acre farm had been misused and abandoned by past owners. But Leopold could see past the damage. His family would restore the worn-out land to health.

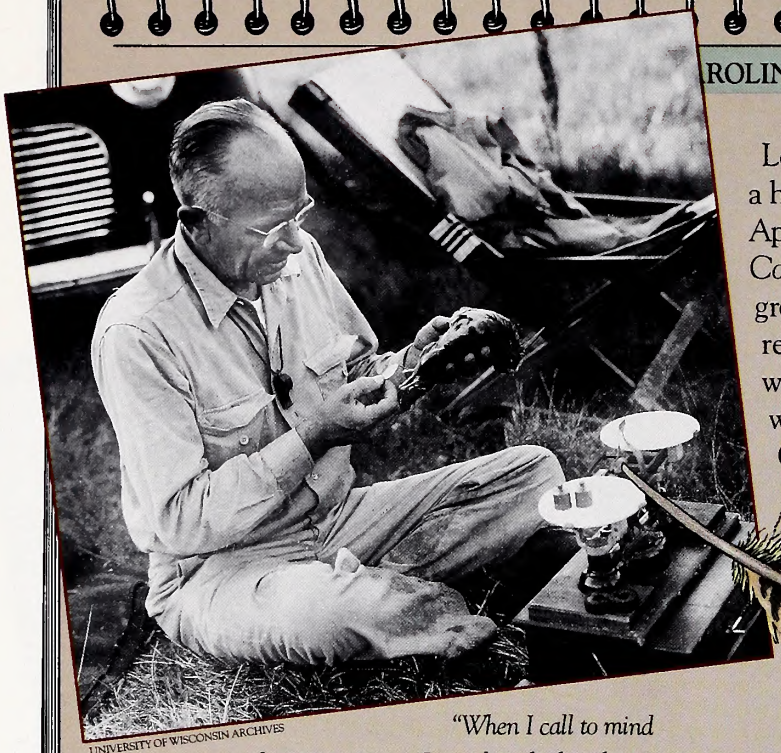
Everyone set to work. They shoveled out chicken manure and collected driftwood to build bunks for the "Shack." They planted pine trees, berry bushes and grain patches for wildlife. When a drought killed many pines, Leopold took careful notes and planned for next spring. The farm's purpose, after all, was more than growing trees. Leopold believed that planting pines, singing by the campfire, and watching for geese were ways to develop a "personal understanding of land."

Leopold soon began writing about his farm experiences. Stories about listening to woodcocks and banding chickadees remind readers that "plants, animals, men, and soil are a community of interdependent parts."

ALDO LEOPOLD FOUNDATION ARCHIVES

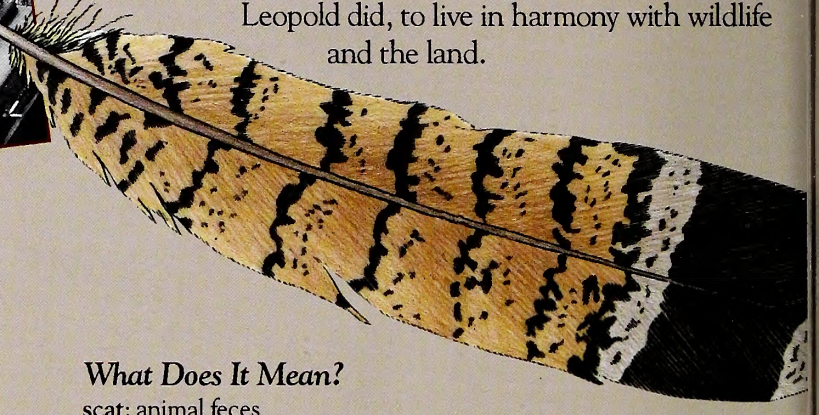


ALDO LEOPOLD FOUNDATION ARCHIVES



UNIVERSITY OF WISCONSIN ARCHIVES

Leopold did not live to see his essays in print. He died of a heart attack, fighting a grass fire on a neighbor's farm on April 21, 1948. At first, few people bought copies of *A Sand County Almanac*. But concern for environmental problems grew in the 1960s, and many environmental leaders read and reread the *Almanac*. Today many call Leopold a pioneer in wilderness preservation. His farm is now a wildlife preserve with acres of prairie grass and towering pines. But *A Sand County Almanac* is Leopold's greatest achievement. Its simple yet powerful words tell how we can learn, as Aldo Leopold did, to live in harmony with wildlife and the land.



"When I call to mind my earliest impressions, I wonder whether the process ordinarily referred to as growing up is not actually a process of growing down; whether experience, so much touted among adults as the thing children lack, is not actually a progressive dilution of the essentials by the trivialities of living."

—A Sand County Almanac

Read and Find Out

- *A Sand County Almanac* by Aldo Leopold, Oxford University Press, 1949.
- *Aldo Leopold: Living with the Land* by Julie Dunlap, Twenty-First Century Books, 1993.
- *Of Things Wild, Natural, and Free: A Story about Aldo Leopold* by Marybeth Lorbiecki, Carolrhoda Books, 1993.
- *Aldo Leopold: A Fierce Green Fire - An Illustrated Biography* by Marybeth Lorbiecki, Falcon Publishing Co., 1996.
- *Aldo Leopold: His Life and Work* by Curt Meine, University of Wisconsin Press, 1988.
- *Taking Care of the Earth: Kids in Action* by Laurence Pringle, Boyds Mills Press, 1996.
- *Game Management* by Aldo Leopold, Charles Scribner's Sons, 1933.

Some websites about Aldo Leopold:

- Aldo Leopold Foundation - http://danenet.wicip.org/alcnc/alf/
- Leopold Education Project - http://www.pheasantsforever.org/lep.html

Photographs courtesy of the Aldo Leopold Foundation Archives.
Editing & design by Consie Powell. Art puzzle by Anne Marshall Runyon.

What Does It Mean?

scat: animal feces
waterfowl: birds such as ducks and geese that live on or near water
natural resource: an area's material sources of wealth, such as forests, minerals or wildlife
forester: a person trained in the science and art of planting, tending and harvesting forests
game: wild animals hunted for food or sport

Get Outside

Read aloud: Choose a chapter from *A Sand County Almanac* to read to your family or class and savor Leopold's wonderful words.

Go hunting: Even without a gun, you can follow a deer's tracks or wait for ducks in a marsh. Bag your quarry with a camera or sketch pad.

Keep a field journal: Carry a sturdy notebook outside with you. Take notes on the kinds of animals and plants you see. Sketch details such as a leaf's shape or a bird's beak. Remember to date your entries so you can follow changes through the seasons.

Take part in your natural community: Plant a tree or build a bird house for your yard. Join a neighborhood group for a stream clean-up or start an environmental club at your school. Help raise money to fix up your local park. What else can you do to improve nature around you? Do it!

Visit the Museum: Look for elk, Carolina parakeets and other creatures that once lived in North Carolina. Study exhibits about native Americans and early settlers. How have people changed the local environment? North Carolina Museum of Natural Sciences. For more information, call (919) 733-7450.

Get WILD

State Environmental Education Conference: February 10-13, 1999 at Sheraton Imperial Hotel, Research Triangle Park. Pre-registration for conference workshops required. For conference information, call Judy Pope at 1-800-482-8724.

Advanced Aquatic Wild Workshop in selected Piedmont counties: February 26-27 - *Salamanders: To Know Them Is To Save Them*. Call: Donna Rogers, (919) 541-5478.

Advanced WILD Workshops:

April 17-18 - *Migratory Songbirds*, Cool Springs Environmental Education Center near New Bern. Call Mike Campbell, (252) 514-6663.

April 24-25 - *Migratory Songbirds*, Howell Woods Environmental Education Center, Smithfield. Call Katrina McDougald, (919) 751-2040.

May 22-23 - *Aquatic Ecosystems*, Fayetteville. Call Katrina McDougald, (919) 751-2040.

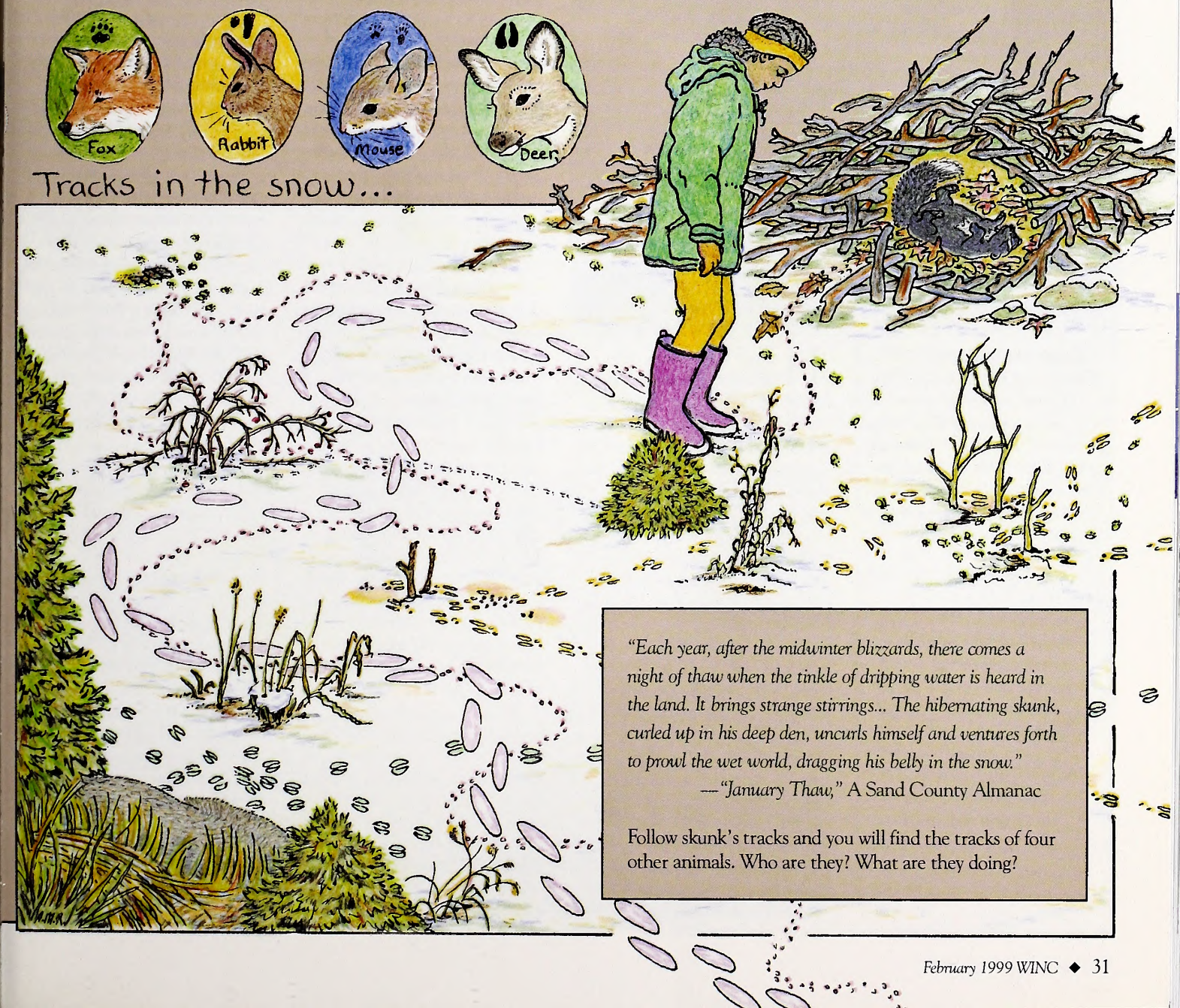
It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

Wild Words... A Journal-Making Activity: teaches students to observe and describe their surroundings, especially out-of-doors.

Changing Attitudes: teaches students to recognize factors that affect attitude changes regarding animals and the environment.

Ethi-Reasoning: teaches students to understand values and beliefs related to wildlife and elements of the environment.



"Each year, after the midwinter blizzards, there comes a night of thaw when the tinkle of dripping water is heard in the land. It brings strange stirrings... The hibernating skunk, curled up in his deep den, uncurls himself and ventures forth to prowl the wet world, dragging his belly in the snow."

—"January Thaw," A Sand County Almanac

Follow skunk's tracks and you will find the tracks of four other animals. Who are they? What are they doing?

Wildlife Commission's Canine Program Reaches a Milestone

KEN TAYLOR

Wildlife Enforcement *Capt. T.M. Whitson (left) presents officer Mike Criscoe and canine officer Link with a plaque recognizing the German shepherd's 10 years of dedicated service. Due to health complications, Link was recently retired and will spend the remainder of his days at the home of officer Criscoe.*

Edited by Chris Powell

He may have been the ultimate wildlife enforcement officer: He worked for free, never complained about holiday duty, made countless arrests and, without hesitation, would have given his life to protect his partner.

But what he will most likely be remembered for was his role in ushering in a new era of wildlife enforcement in North Carolina.

Link, the first canine ever used for enforcement by the Wildlife Commission, was recently retired after a decade of service. The 13-year-old German shepherd was declared inactive due to arthritic hips and will spend the remainder of its days at the Maggie Valley home of his handler, officer Mike Criscoe.

With the full canine unit assembled at the Maggie Valley Police Department, Link and officer Criscoe stood at attention as a long list of the team's achievements were announced.

"Today, canine Link has reached the point in his life that we all work toward—retirement," said officer Paul Linder, while addressing a small audience. "He has served honorably and faithfully as a law enforcement canine officer with the North Carolina Wildlife Commission for 10 years. With his handler, master officer Mike Criscoe, he leaves behind a track record that will be hard to follow."

As a puppy, Link was acquired in 1986 for the Wildlife Commission's pilot canine program. Three years later, he was trained at the Mid-Atlantic Canine Training School, with emphasis on tracking, handler protection, apprehension, suspect and article search as well as search and recovery.

Link was involved in more than 300 major wildlife cases during his career, never once receiving a complaint from the public. He found lost children, sniffed out hidden game, unearthed shell casings, located marijuana fields and led his handler directly to fishermen and hunters in isolated areas.

On one particular case, the State Bureau of Investigation requested Link's assistance to find three murder weapons that had been missing for three months. The task took Link 27 minutes, earning him recognition from the National Police K-9 Organization for "Top Case of the Quarter."

In 1993, Link deterred a threatening encounter involving two night deer poachers. Officer Criscoe had approached the two subjects and ordered their weapons dropped. However, the two men refused, creating a "situation" for the lone officer. Criscoe immediately placed Link on alert, and the 110-pound dog transformed from an attentive observer to a snarling, vicious animal. The suspects quickly put down their weapons and picked up charges that included safecracking, armed robbery and assault on a law enforcement officer.

During his storied career, Link achieved somewhat of a celebrity status, earning mention in national publications such as *Field and Stream* and *Sports Afield*, as well as numerous state newspapers and magazines.

The pilot program under Link proved so successful, the Wildlife Commission expanded the use of canine enforcement in 1996. Criscoe now oversees nine teams deployed throughout the state.

Six North Carolina wildlife patrol teams participated in the 1998 United States Police Canine Association certifications. Each team received scores high enough to compete in the national trials. Of the 61 canine teams from 26 law enforcement agencies, four North Carolina wildlife teams were recognized as the best trained.

The 1998 certifications were the first Link had missed in 10 years. But if he wasn't there in body, Link was certainly there in spirit. Criscoe attributes much of the canine program's success to the groundwork laid by his four-legged friend. And though Criscoe has already begun training a new dog, he readily admits that his former partner will never be replaced.

"Link has been a wonderful friend for 10 years," Criscoe said. "I have trusted Link with my life, and his presence on the job will be missed. My only solace is that I will have the pleasure of seeing him daily when I return home."

—*Chris Powell*

Conference to Feature Key Environmental Speakers

Some of the leading environmental educators throughout the country will be attending the 1999 Environmental Education Conference, Feb. 10-12 at the Sheraton Imperial, located in the Research Triangle Park.

The purpose of the conference is to demonstrate and debate the value of a knowledge-based, learning-driven approach to environmental quality. More than 700 government, educational and business representatives will gather to examine the role of environmental awareness and importance.

One of the guest speakers will be Steve Curwood, producer of National Public Radio's Pulitzer Prize-winning program "Living On Earth."

Curwood, who will open the conference the evening of Feb. 10, said he plans to speak about the fundamental need people have for nature.

"Just like we need exercise, we were designed to need contact with other species," Curwood said. "Studies show that people recovering from surgery have less pain if their hospital window shows some natural space."

"With modern, urban life, often children don't get to experience nature," he added. "So environmental education is a large part of getting us in touch with other species, bringing animals into classrooms and getting children out on hikes."

The evening of Feb. 11, Paul Hawken, an author an noted environmentalist, will speak about the role industry has in promoting environmental stewardship.

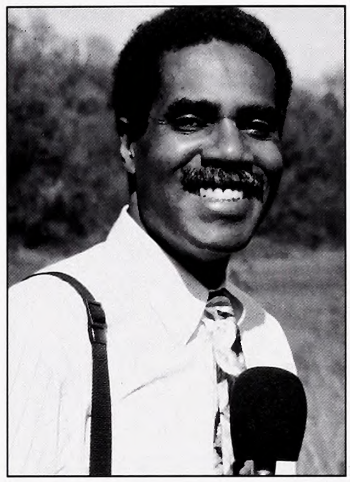
In addition, hundreds of other successful educators will share their effective environmental education classroom strategies. Different environmental programs will also be showcased, such as the Project Tomorrow Environmental Education Library Grant Program, Project WILD and Project Learning Tree. Other highlights will include presentations on environmental education activities using Geographic Information Systems as well as the Internet.

North Carolina is becoming widely recognized for its strides to complement the traditional regulatory-driven approach to environmental management through increased environmental education, said Anne Taylor, director of the Department of Environment and Natural Resources Office of Environmental Education.

"There is growing recognition that North Carolina's regulatory-based environmental policy alone will not ensure the quality of life North Carolinians want for their families," she said. "North Carolina has the very highest quality environmental education infrastructure of any state in the nation and is well positioned to become the state recognized above all others for its environmental stewardship."

For more information about the 1999 Environmental Education Conference, contact the Office of Environmental Education at 1-800-482-8724; E-mail (ncee@mail.enr.state.nc.us) or (http://www.enr.state.nc.us/ENR/ee).

—Courtesy of the Department of Environment and Natural Resources



***Steve Curwood,** host of National Public Radio's program "Living on Earth" will be one of many featured speakers at the 1999 Environmental Education Conference.*

Outdoor Tip

There are few things more discouraging than discovering the hard way that your waders aren't seaworthy. Leaks can be as small as a pinhole and very hard to find. To locate a puncture, take the waders into a dark room and place a flashlight or light bulb inside. In extreme cases, fill the boots with water. If water can get in, it can also get out.

—F. Eugene Hester, Zebulon

Editor's note: *Do you have a tip or suggestion you would like to share with our readers? If so, please write Chris Powell at 512 N. Salisbury St., Raleigh, N.C. 27604; Fax: (919) 715-2381; E-mail: (powell.chris@coned.wildlife.state.nc.us)*

Field Notes

Rabbit	Through Feb. 27
Raccoon and Opossum	See *Regulations Digest*
Bobwhite Quail	Through Feb. 27
Ruffed Grouse	Through Feb. 27
Common Snipe	Through Feb. 27
Crow	See *Regulations Digest*
WATERFOWL	
Snow and Blue Geese	Through March 10

Information on bag limits and other regulations may be found in the *1998-99 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest*. For a copy, check with license agents or contact the N.C. Wildlife Resources Commission. For more information on waterfowl regulations and limits, call 1-800-675-0263.

Topo Maps Available

Whether your recreation is hunting, fishing, hiking, bird watching or boating, good maps are a necessity for success and safety in the outdoors.

Thankfully, the North Carolina Geological Survey stocks topographic maps for every area of the state at a cost of $4 per map. In addition to topo maps, there is also a wide selection of geological publications available, many pertaining to recreational geology.

The Geological Survey's map and publication sales office is located in the basement of the Archdale Building at 512 N. Salisbury St. in Raleigh. To place orders or request more information, call (919) 715-9718 or write the NCGS at P.O. Box 27687, Raleigh, N.C. 27611-7687. Orders can also be faxed to (919) 733-0900 or placed by e-mail at ncs1440@interpath.com. Visit the NCGS web site at: http://www.enr.state.nc.us/ENR/DLR/ncgeology/Default.htm.

Maps are shipped the same day orders are received. Sales are subject to a 6 percent sales tax and a small handling fee. MasterCard and VISA credit cards are accepted as well as personal checks and cash.

State Black Bear Record Falls

A hunter shattered the state's existing black bear record and possibly set a new world record in November by taking an 880-pound bear from an eastern North Carolina thicket.

Coy Parton, of Sevierville, Tenn., killed the bruin with buckshot after a chase with hounds near Vanceboro in Craven County. The massive male bear exceeded the previous North Carolina record by 160 pounds. That bear was also taken in Craven County just a few miles away.

Parton's bear may be the largest black bear ever harvested on record, according to Mark Jones, the Wildlife Commission's black bear project leader. "I've been checking with other bear-hunting states around the country and in Canada and I've yet to find a bigger black bear," Jones said.

The largest specimen Jones could find was an 820-pound bear taken in Pennsylvania.

Jones credits the superior food supply and plentiful habitat of eastern North Carolina along with the Wildlife Commission's strong sanctuary system with helping produce the massive bear. Black bears in excess of 600 pounds have been routinely taken from eastern North Carolina in the past few years.

"The sanctuary system has proven itself for close to 30 years," Jones said. "There is plenty of strong evidence that these sanctuaries have benefited bear populations in North Carolina."

The Wildlife Commission established 28 bear sanctuaries in 1970, setting aside more than one-half million acres of land across the state where bear hunting is prohibited. With the protection afforded by the sanctuaries along with carefully managed hunting regulations, Tar Heel bear populations have surged to an estimated 9,000 bears.

Bear populations have risen steadily in the Mountains in the past decade. But the biggest growth—both in bear size and numbers—has come on the Coastal Plain where large tracts of undeveloped land bordering agriculture fields harbor some 6,000 bears. "Bears are doing extremely well on both ends of the state," Jones said. "But on the coast, we've really seen the bear population take off."

—Rodney Foushee

N.C. Wildlife Officers Go for the Gold

The North Carolina Wildlife Resources Commission's "Team Wildlife" took home an assortment of medals from the 1998 North and South Carolina Police Olympics, held recently in Charlotte.

Sgt. John Massey won two gold medals in the weight lifting open and masters division, with a bench press of 415 pounds. Officer Rick Purcell, a Wildlife Commission pilot, won a silver in the Karate fighting event and a bronze in the weapons event. Capt. Ken R. Craft won a silver in the "Toughest Cop Alive" master's division. And, officer W.T. Kennedy won a bronze medal in the "Toughest Cop Alive" senior's division. Officer Barry Joyce competed in all of the shooting events, barely missing a medal.

—courtesy of the N.C. Wildlife Resources Enforcement Division

***The Wildlife Commission** Enforcement Division's "Team Wildlife" recently competed in the 1998 North and South Carolina Police Olympics. Front row from left are: officers W.T. Kennedy and B.D. Joyce. Back row from left are: Capt. Ken Craft, Sgt. John Massey and Senior Pilot Rick Purcell.*

Division of Inland Fisheries' Tackle Loner Program Gets a Boost

The North Carolina Wildlife Resources Commission will have an easier time teaching kids how to fish, thanks to a recent contribution from the Bass Anglers Sportsman Society (BASS) and Zebco Corporation.

The two organizations donated a total of 126 rod-and-reel combos at the conclusion of the BASS Kid's Classic, held in Greensboro at the Oka T. Hester Park—one of the Wildlife Commission's premier Community Fishing Program sites.

"Ed Cannon, president of the N.C. State BASS Federation, and his officers were instrumental in convincing BASS Federation national director Don Corkran and Zebco Corporation to make the donation," said Bob Curry, fisheries program manager for the Wildlife Commission's Division of Inland Fisheries.

The Zebco 404 combos were distributed to Wildlife Commission fisheries biologists and management crews in the Piedmont region. The donated gear will be used at instructional fishing clinics or fish-for-fun events at the Wildlife Commission's Community Fishing Program sites.

"We really appreciate the BASS Federation's support with this program and with teaching children the joys of fishing," Curry said. "We are very fortunate to have such strong support from the N.C. State BASS Federation."

The rods and reels have already been used in some of the Wildlife Commission's fish-for-fun events. The first clinic, held in the Salisbury area less than two weeks after the Kid's Classic, introduced 60 children to fishing for the first time.

The Community Fishing Program provides urban residents with a quality fishing location where the odds of catching a fish are increased as a result of intensive fishery management activities. Fish-for-fun events teach aspiring anglers (children as well as adults) fishing techniques such as casting, knot tying, terminal tackle placement and bait presentation.

GERALD CRAWFORD

***The Bass Anglers Sportsman Society** and Zebco Corporation recently donated 126 rod and reel combos to the N.C. Wildlife Resources Commission. From left are: Ed Cannon, president of the N.C. State BASS Federation; Pee Wee Powers, a national BASS Federation representative; and Fred Harris, chief of the Wildlife Commission's Division of Inland Fisheries.*

North Carolina Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

Feb. 6-7

The Piedmont hunting club, as part of the National Bird Hunters Association, will hold a weekend bird dog trial at Monroe. For more information, call Floyd McGee at (919) 772-4395.

March 5-7

The 18th annual Dixie Deer Classic will be held in the Jim Graham Building at the North Carolina State Fairgrounds in Raleigh. The event is one of the nation's largest deer hunting expositions and draws thousands of hunters each year. For more information, call (919) 782-5333.

March 5-6

The N.C. Taxidermy Association winter competition will be held at the Ramada Inn Blue Ridge in Raleigh. The event will feature some of the state's top taxidermist competing in various types of animal categories. For more information, call Tommy Hall at (704) 753-1470.

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through November 1998

Principal Balance
$26,758,064.10

Interest Earned
$26,934,291.73

Total Receipts
$53,692,355.83

Interest Used
$15,250,446.04

Fund Balance
$38,441,909.79

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.

Building Critter Boxes

by Rodney Foushee

With winter's chill in the air and most of hunting season wrapped up, February is a great time to settle down to the workbench and build nesting boxes for birds and other wildlife. Bluebirds, wood ducks, owls, bats and flying squirrels are just a few of the species that will appreciate your handiwork.

Building just one nesting box from scrap materials is fine, but you can make more of an impact for wildlife and maximize your effort by building multiple boxes at the same time. The key is getting the right materials, tools and a good set of plans. Common lumber, such as pine, is adequate for most projects, but more rot-resistant wood, such as cypress or cedar, lasts longer. However, it is also more expensive. Whatever your choice, stay clear of treated lumber because the fumes it produces are harmful to animals.

The debate over nails and screws rages on, but most craftsmen agree that screws are a more permanent choice for fastening wood. If practical, attach your new nesting boxes to a metal pole or wooden post with the entrance hole facing south. If you must attach the box to a living tree, don't drive the nail or screw all the way in. Instead, leave an inch or more of space to make room for the tree's future growth. A cone-shaped metal predator guard is also a must to prevent snakes and raccoons from marauding the boxes when they are in use.

Though some critter will use virtually any structure, individual species require specific box dimensions and entrance hole diameters. That's where a good set of plans comes in handy. For plans for building a variety of nesting boxes and bird feeders, you can order *Bird Houses & Feeders: How to Build Them and Enjoy Them* for $2 from the Wildlife Commission at (888) 629-4535. The Commission also offers a free guide on wood ducks including plans for building nest boxes and predator guards by calling (919) 733-7291. A third publication, *Building Songbird Boxes*, is available from your local Cooperative Extension Service office.

Once you have the plans, materials and a few basic tools, think big about nesting boxes. Get your spouse, children or grandchildren involved in a weekend box-building party! With an assembly-line approach, you can churn out a half-dozen boxes in no time. Just make sure you get the new boxes up by April, so wildlife can make use of them this spring.

N.C. WILD STORE

And now *for our* feature presentations.

Coming soon to a VCR near you. The N.C. WILD Store proudly presents four unique nature videos, featuring cameo appearances by an all-star cast of wildlife. Hurry and find your seats, as the outdoors comes indoors with four interesting and educational adventures the whole family can enjoy. Pop the corn, pour the sodas and dim the lights—the shows are about to begin. Sh-h-h...

ALL THINGS ARE CONNECTED

Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.

ITEM CODE **W1**

PROTECTING OUR WILDLIFE HERITAGE

25-minute video offers useful tips for landowners on managing small game. $20.

ITEM CODE **N8**

BRIGHT WATERS

30-minute video on fishing and fisheries management in North Carolina's freshwater creeks, rivers and ponds. $20.

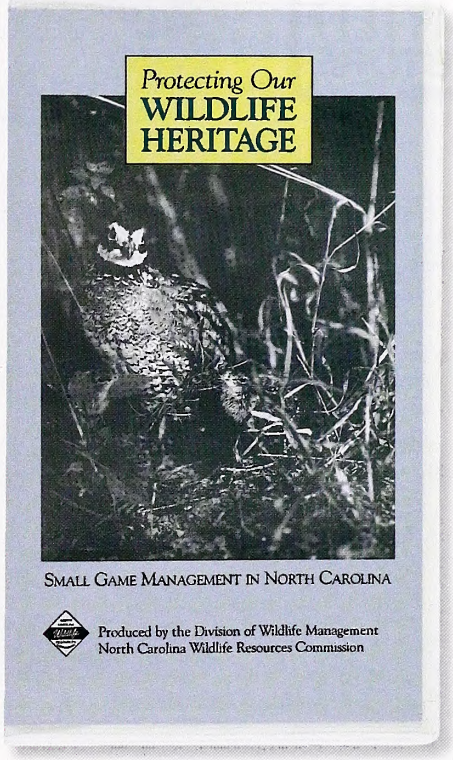
ITEM CODE **N7**

WILDLIFE BABIES

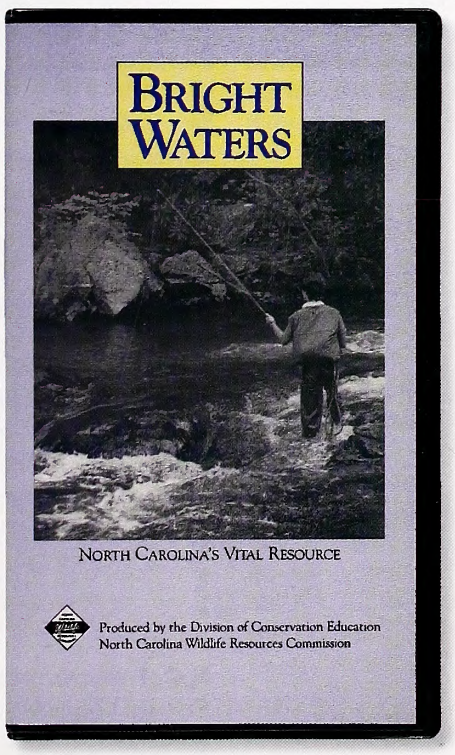
Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others. $20.

ITEM CODE **N9**

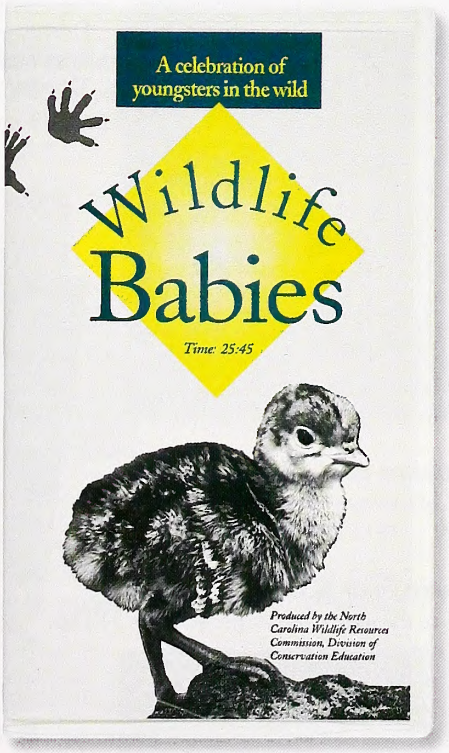
environmental ethics



habitat for small game



freshwater fish



youngsters at play

More terrific items

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

WATERFOWL DECOYS OF N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.
ITEM CODE P12

N.C. WILD CAP

N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50.
ITEM CODE A1

WILDLIFE IN N.C. CAP

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE A3

WILDLIFE IN N.C. CAPS

Each embroidered with magazine logo and buck deer silhouette. Described left to right. $16.50 each.

Blaze orange with brown waxcloth bill. ITEM CODE A7

Advantage® Camouflage with tan suede bill. ITEM CODE A6

Sold Out! Stone with navy canvas bill. ITEM CODE A2

FROGS OF N.C. (THE HYLIDS)

Presents all 15 of the state's tree frogs, cricket frogs and chorus frogs. 22" x 34". $6. ITEM CODE P11

LIZARDS OF N.C.

12 of the state's lizard species. 22" x 34". $6. ITEM CODE P3

TURTLES OF N.C.

21 of the state's turtle species. 22" x 34". $6.
ITEM CODE P4

SNAKES OF N.C. (LIVEBEARERS)

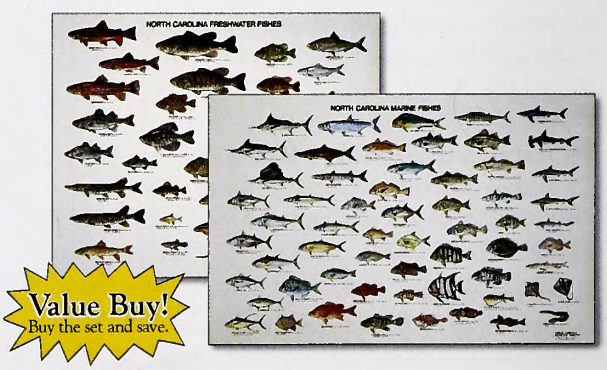
17 of the state's snake species. 22" x 34". $6. ITEM CODE P5

SNAKES OF N.C. (EGGLAYERS)

19 of the state's snake species. 22" x 34". $6. ITEM CODE P8

SET OF 4 POSTERS

Save $6 by purchasing the set of four posters (P3-P8). $18.
ITEM CODE P10



N.C. FRESHWATER FISHES

Find your favorite fish with this color poster showing 36 of the state's freshwater fishes. 28" x 22½". $6. ITEM CODE P6

N.C. MARINE FISHES

All the colors of the sea can be found on this poster of 60 marine fishes. 35" x 22½". $6. ITEM CODE P7

N.C. FRESHWATER AND MARINE FISHES

Save $2 when you buy both posters as a set. $10. ITEM CODE P9

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50. ITEM CODE **M9**

Also available as a boxed set. $30. ITEM CODE **M10**

North Carolina WILD Places Map

Artist's Proof. $40. ITEM CODE **E2**
Limited Edition. $25. ITEM CODE **E3**
Poster. $6. ITEM CODE **E4**

Dogs that Point, Fish that Bite

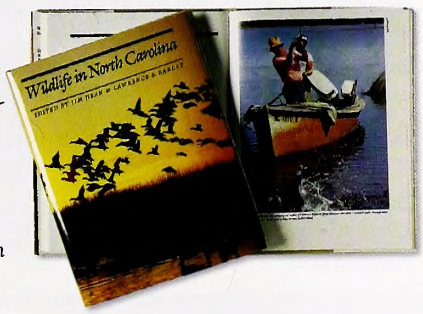
Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. $19.95. ITEM CODE **M8**

North Carolina WILD Places Posters

(Set of 3): Posters of "Old Field" and "Mountain Cove Forest" from *North Carolina WILD Places: A Closer Look*. 19 1/2" x 16". Shipped folded with poster version of WILD Places Map. $8. ITEM CODE **E5**

Wildlife in North Carolina Book

The best of *Wildlife in North Carolina* magazine. Hardbound. $12. ITEM CODE **M3**



Magazine Binder

Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. $10. ITEM CODE **M2**

WILD Places book and posters

Buy the *North Carolina WILD Places* book and all three posters and save! (Items E1 and E5) $16. ITEM CODE **E6**

Value Buy! Buy the set and save.

Bird Houses & Feeders: How to Build and Enjoy Them

An eight-page illustrated guide to building bird houses and feeders. $2. ITEM CODE **M6**

North Carolina WILD Places: A Closer Look

Easy-to-read text and Anne Marshall Runyon's delightful illustrations make wildlife habitats come alive in this 82-page book. Discusses 13 habitats across the state. $10. ITEM CODE **E1**

Scouting Correlations

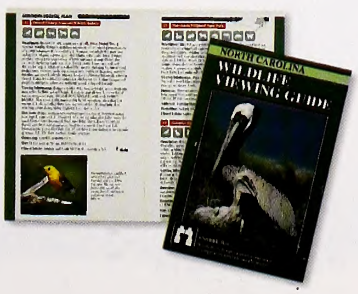
Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each $3.
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**

North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. $6. ITEM CODE **E7**

North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. $5.95. ITEM CODE **N6**



North Carolina WILD Journal

Handy calendar notes on wildlife behavior through the year, with room for personal observations. Supplements N.C. WILD Education Sites workshop. $6. ITEM CODE **E8**

More terrific items

N.C. WILD STORE

All Things Are Connected & This Land Is Sacred
Video and Teacher's Guide package. $22. ITEM CODE **W3**

Gardens for Butterflies
Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. $2. ITEM CODE **M5**

All Things Are Connected
Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.
ITEM CODE **W1**

This Land Is Sacred (Teacher's Guide)
Classroom activities to accompany All Things Are Connected video.
$4.50. ITEM CODE **W2**

N.C. WILD Notebooks
Each set contains eight issues of *North Carolina WILD Notebook*, the Commission's prize-winning conservation education newsletter. $3 per set.

'95-'96 Set ITEM CODE **E11**

'96-'97 Set ITEM CODE **E12**

White, 100% cotton (preshrunk) T-shirts are guaranteed for comfort and durability. Each shirt features an original design.

Wildlife in N.C. T-shirt
WINC magazine logo on front pocket. Tundra swan art on back. $14.50.
ITEM CODES:
A5MED (medium)
A5LRG (large)
A5XLG (extra large)
A5XXL (extra extra large)

N.C. WILD T-shirt
N.C. WILD logo printed on front and colorful art on back. $14.50.
ITEM CODES:
A4MED (medium)
A4LRG (large)
A4XLG (extra large)
A4XXL (extra extra large)

Coming Soon!

WILDlife Profiles Binder
Organize WILDlife Profiles with this notebook binder complete with table of contents, species tab dividers and index.

Traditional Trout Flies of the Southern Appalachians
Framable, high-quality poster is the second in the "Sporting Heritage" series.

WILDlife Profiles
Each set is designed to fit your standard 3-ring binder and features 10 animal fact sheets. **$2 per set.**

Set 1. Black bear, raccoon, white-tailed deer, striped skunk, bobwhite quail, wild boar, muskrat, mourning dove, coyote, mallard. ITEM CODE **W4**

Set 2. Mink, canvasback duck, red fox, wild turkey, beaver, American river otter, Canada goose, bobcat, red wolf, cougar. ITEM CODE **W5**

Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass. ITEM CODE **W6**

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.
ITEM CODE **W7**

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster. ITEM CODE **W8**

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat. ITEM CODE **W9**

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.
ITEM CODE **W10**

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad. ITEM CODE **W11**

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish. ITEM CODE **W12**

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet. ITEM CODE **W13**

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet. ITEM CODE **W14**

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.
ITEM CODE **W15**

WILDLIFE COMMISSION

SPOTLIGHT

An Abundance of Turkeys

KEN TAYLOR

KEN TAYLOR

KEN TAYLOR

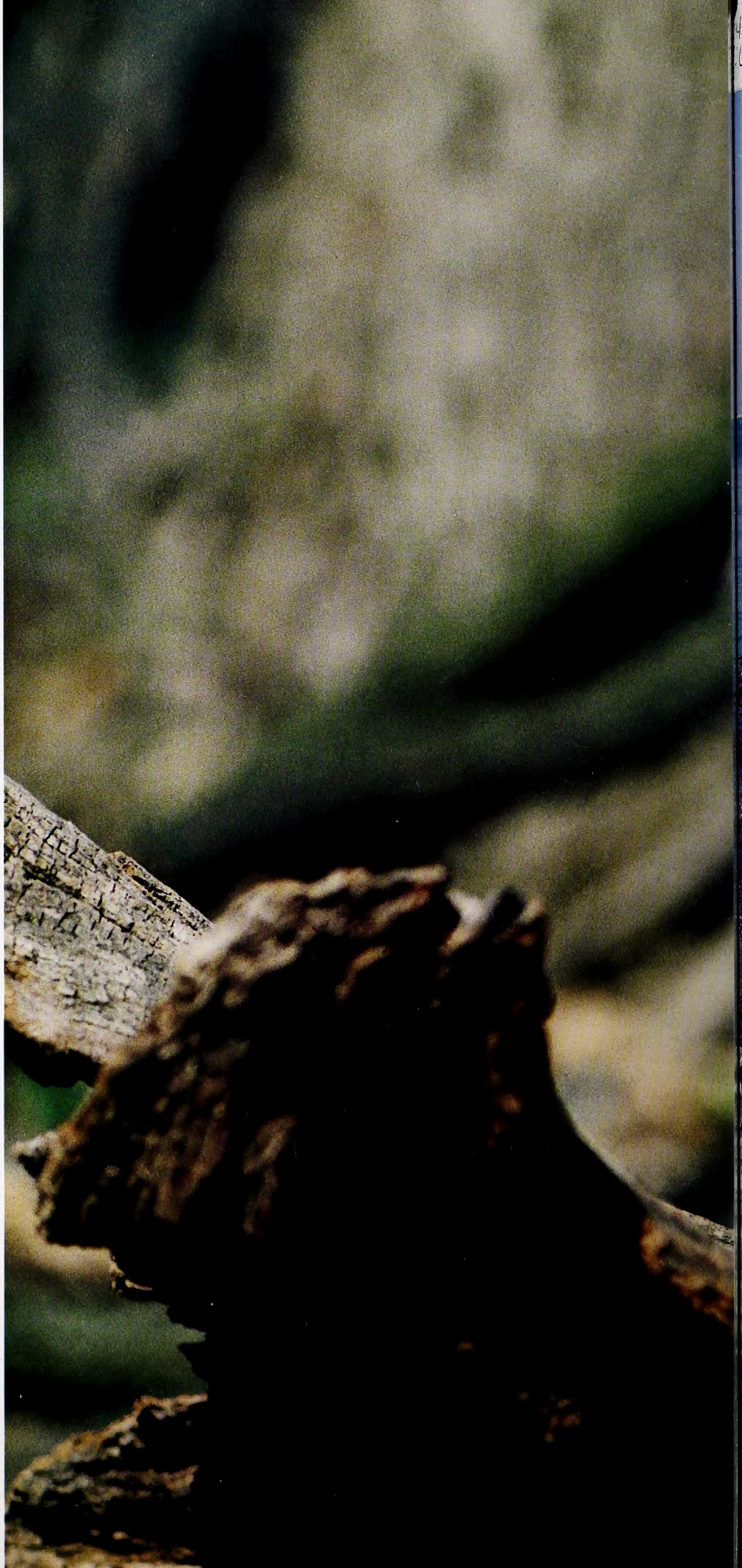
Wiped out from much of the state, wild turkeys have made a triumphant comeback in recent years thanks to the restocking efforts of the Wildlife Resources Commission.

SCOTTY LOVETT

Once abundant throughout much of North Carolina, wild turkey populations began to plummet during the late 1800s due to overharvest and habitat destruction. Though hunting regulations were imposed during this century, turkey numbers continued to decline as forests were cleared and remaining turkey populations became isolated.

By 1970, there were an estimated 2,000 birds left in North Carolina. But thanks to the Wildlife Resources Commission's turkey restoration program, there are 100,000 birds in the state today.

Since 1970, Wildlife Commission biologists and technicians have released nearly 5,000 birds on more than 300 restoration sites across the state. The turkeys are trapped in late winter from wild flocks using rocket nets and released in other locations. Thanks to the dedication of wildlife biologists and the support of sportsmen, wild turkeys now exist in 99 of the state's 100 counties. As a bonus, 62 new areas in 34 counties will be opened to gobbler hunting this spring.



Strutting His Stuff

Hardly anyone but the patient photographer ever sees a ruffed grouse in the open. Usually the bird explodes out of the rhododendron in a heart-pounding instant, fading in a brownish blur into the wintry vegetation on the other side of the trail.

Periodicals postage paid at
Hickory, North Carolina

LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
CONOVER, NORTH CAROLINA

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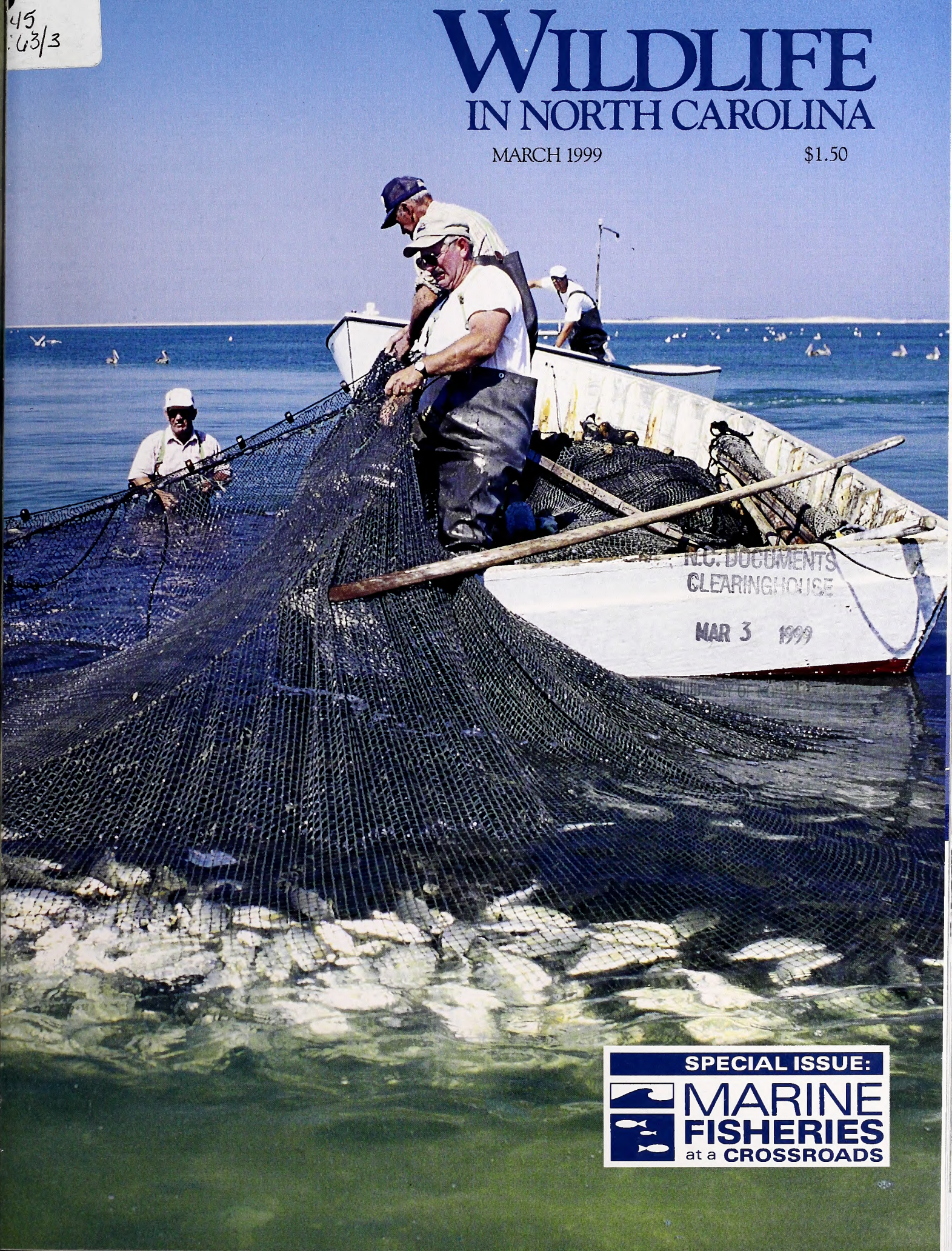
WILDLIFE IN NORTH CAROLINA

MARCH 1999 $1.50



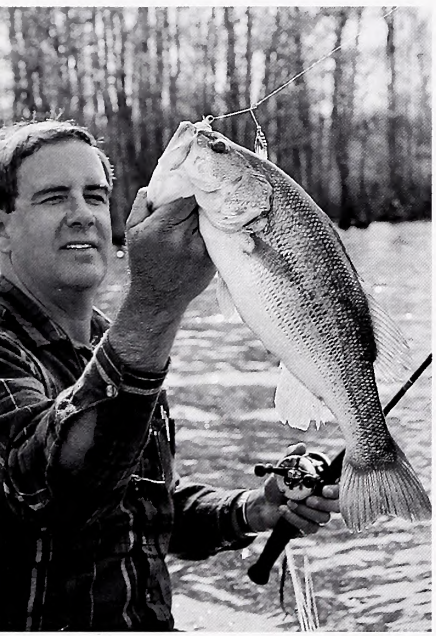
N.C. DOCUMENTS
CLEARINGHOUSE
MAR 3 1999

SPECIAL ISSUE:

MARINE FISHERIES at a CROSSROADS

How to Jump-Start a Bass

by Jim Dean ©1998



JIM DEAN

"One of the more endearing and human traits we share with bass is that apparently we both think about spawning a long time before we get around to it."

Imagine the reaction you'd have gotten from your bass fishing buddies some 25 years ago if you had begun to talk about prespawning. "Hey, hey, we don't want to hear about your problem," they might have said with an involuntary shudder. Not so anymore. Every knowledgeable bass fisherman nowadays speaks fluent "prespawn." Learn the lingo and it can give you your best shot of the year at a real lunker largemouth weeks—even months—ahead of balmy weather.

Modern bass fishermen have learned that it pays to get started by mid-February—certainly no later than early March—as water temperatures rise past the 50-degree mark. Although bass don't begin to spawn until the water temperature reaches about 68 degrees in April or May, the whole period falls into this prespawn cycle, and the fishing can be great if you use the right tactics.

Some of the best prespawn fishing I've had in recent years has occurred as the water temperature hit that 52- to 55-degree range. Last year, on February 20th, I found bass in the sunny, shallow end of a pond and caught a 4-pounder and a 6½-pounder on back-to-back casts using a spinnerbait. A couple of days later, the combination of sunlit shallow water and spinnerbaits yielded over a dozen fat bass. Even earlier in the month, my companion and I had already been catching fish in deeper water on crankbaits. We worked the lures slowly, stopping them frequently, and most of the strikes occurred while the lures were stationary.

You could fill a book with useful tips for successful late winter and early spring bass fishing, but here is an abbreviated sample of some that have worked for me. I generally begin fishing in ponds because these shallower waters tend to warm more quickly, but big lakes can be good, too. Early in the season, deep-running crankbaits and spinnerbaits fished slow and deep off points and along riprap are likely to be your best bet, but as the water warms, bass will begin to make forays into the sunny shallows to feed and bask. In large lakes, alternate your deeper water cranking by periodically fishing the sunny banks, flats and backs of coves. Creeks that enter a lake often carry slightly warmer water, too. A thermometer is nearly essential.

As the season progresses, bass spend more and more time in the shallows, and it's not just food they're after. Although the actual spawning season may be weeks away, big females are already checking out likely shallow spawning sites. One of the more endearing and human traits we share with bass is that apparently we both think about spawning a long time before we get around to it.

Even early in the season, I usually have my best luck during periods of warmer, sunny weather. Indeed, cold fronts tend to force bass back into deeper water for several days. When conditions are favorable, you might be shocked to find whoppers in water that is only a foot or so deep, especially around cover such as logs, flooded willows and grass clumps.

One warm overcast day in March a few years ago, a companion and I had amazing luck fishing cover in water so shallow that we could often see fish moving. We made short casts with lightly weighted soft plastic salamanders to those targets and were rewarded with some dandy largemouths. Who says soft plastics work only in hot weather?

You don't need a lot of different types of lures to handle most prespawn patterns. For deeper water, I like diving crankbaits—especially those made of balsa—because their inherently lively action seems to have extra appeal even when you stop them momentarily. Big willow-leaf spinnerbaits are excellent not only slow-rolled deep, but also in the shallows. In recent years I have also discovered that smaller versions (⅛- and ¼-ounce) are sometimes more effective in the shallows, especially if the water is clear. A pig 'n jig is another good spring choice.

Though worms and similar soft plastics can be effective this time of year, I stick with salamander configurations because I believe they are more effective. Salamanders tend to breed in shallow, fishless puddles, but lots of them apparently wind up along shoreline shallows where bass may consider them threats to their upcoming egg-laying activities.

Oh yes, just in case you're one of those fishermen who can't wait until bass begin striking topwater lures, you might be interested to know that a buzzbait with its big, noisy prop will often catch bass surprisingly early in the spring long before other topwater lures become effective. They can be especially deadly on days when the water is rippled by wind.

Maybe you haven't been giving too much thought to spawning of late (fat chance), but big bass are. Get out there and introduce yourself to one.

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Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment only by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 1-800-662-7726. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Tremendous Teeth

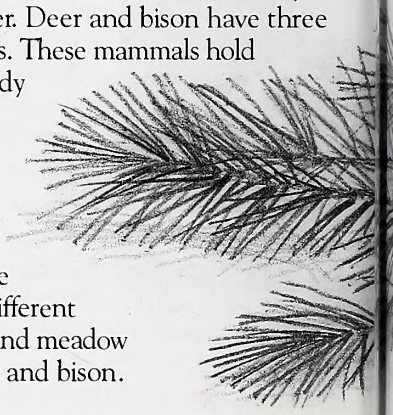
written by Roger A. Powell ©1998
illustrated by David Williams

A mammal's teeth may be small, but they tell more about its life than just about anything else. Unlike reptiles and fish, whose teeth are all the same, mammals can have four types of teeth: incisors, canines, premolars and molars. People have all four of these types of teeth, as do bobcats, deer and possums. Incisors are the teeth at the front of the mouth; canines are often long, pointed teeth; and premolars and then molars are found in the back of the mouth and are used for chewing.

All toothed mammals also have two sets of teeth: baby teeth that fall out and permanent or adult teeth. Teeth erupt on a schedule that is the same for all members of a species. Thus, by finding out which deciduous (baby) and permanent teeth have erupted you can discover the age of a mammal. But after all the permanent teeth have appeared, tooth wear can reveal more about how old the animal is.

Indeed, as a mammal grows older, the food it eats slowly wears down its teeth, despite the fact that the enamel of mammalian teeth is the hardest substance made by any living organism—it is harder than bone and harder than an oyster's shell. An old mammal's teeth are worn with smoothed points, while a young mammal's teeth are shiny and sharp.

Teeth also tell us a lot about what a mammal eats and how it eats. Herbivores' incisors enable them to cut plants into tiny bits. Beavers and rabbits have matched upper and lower pairs of large, snipping incisors that wear down rapidly from cutting fibrous leaves and bark, but they grow continuously and keep sharp by rubbing against each other. Deer and bison have three broad incisors on each side of the lower jaw, but no upper incisors. These mammals hold leaves and small branches between their lower incisors and sturdy upper gums and tear them loose. The canines of deer and bison masquerade as incisors, making a fourth tooth at the front of each side of the lower jaw. Beavers and rabbits have no canines.



Premolars and molars (the cheek teeth) of herbivores have ridges of enamel separated by grooves. As an herbivore chews, pieces of leaf or bark that stick out of the grooves get sliced as the enamel ridges pass each other. Different herbivore species have different ridge patterns. The looping ridges of the cheek teeth of beavers and meadow mice are very different from the crescent-shaped ridges of deer and bison. Rabbits and kangaroos, meanwhile, have parallel ridges.

Predatory mammals have small incisors for nipping and manipulating food, large canines for catching and holding prey, and cheek teeth made to slice. The premolars of these mammals are long and narrow with one major point, except for the last upper premolar. This premolar meets with the first lower molar when chewing and, together they have a special name—carnassials—and a special job—superior slicing. These matched teeth rub past each other just right to stay sharp and they hold meat in the notches between their points. You might see your dog or cat slide a piece of gristle back and to the side of its mouth to cut it with its carnassials.

Omnivorous mammals, such as black bears and raccoons, and seed-eating mammals, such as deer mice and chipmunks, have cheek teeth with rounded cusps, like ours. These cusps crush and pulverize foods that require neither sharp enamel ridges nor slicing teeth. From the skull of a rodent, you can tell whether its diet was largely seeds and insects (its teeth would have rounded cusps) or leaves (enamel ridges).

When teeth stick out of a mammal's mouth, chances are they are not used for eating at all. The canines of a warthog, for example, curl up and out. Two incisors on elephants have become large tusks. One incisor on the narwhal has become a long spear. These teeth are used in social interactions with other members of the same species, and they are used by males to compete for mates.

Alas, an anteater has no teeth at all. It crushes ants and termites against the roof of its mouth with its tongue. All mammals with no teeth eat soft-bodied insects. So, even not having teeth tells something.

Roger Powell is an associate professor of zoology at N.C. State University.

Other Reading

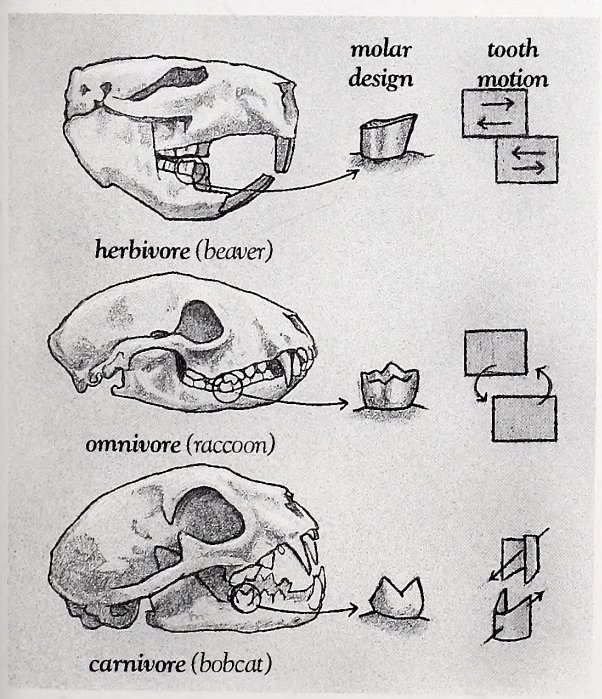
- Whitaker, John O. *National Audubon Society Field Guide to North American Mammals* (Knopf, 1996).

Surfing the Web

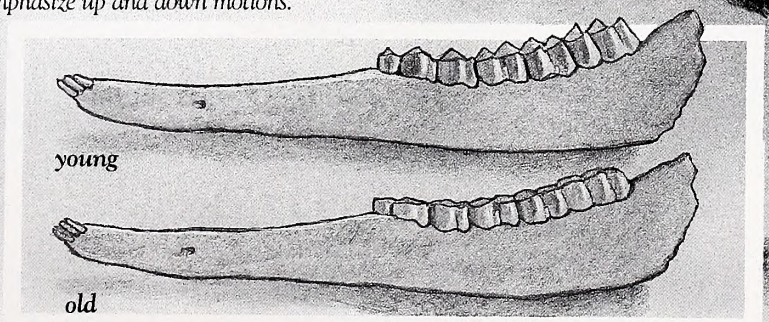
- For a web site devoted to mammalian teeth, see The University of Michigan Museum of Zoology's Animal Diversity Web page. Follow the prompts to "mammals" and then to "teeth." *Address:* http://www.oit.itd.umich.edu/projects/ADW/
- See the web site Mammal Species of the World, at the National Museum of Natural History, Smithsonian Institution. *Address:* http://nmn.hwww.si.edu.msw/

Mammals' teeth match *what they eat. Bobcats and other predators use their canine teeth to catch and hold prey and their cheek teeth to slice through flesh. Herbivores such as cottontail rabbits use teeth specialized for grinding to eat grasses and leaves.*

Teeth that project *from a mammal's mouth are usually not used for eating, but for social interactions. Wild boar males use their canines in contests to gain mates.*

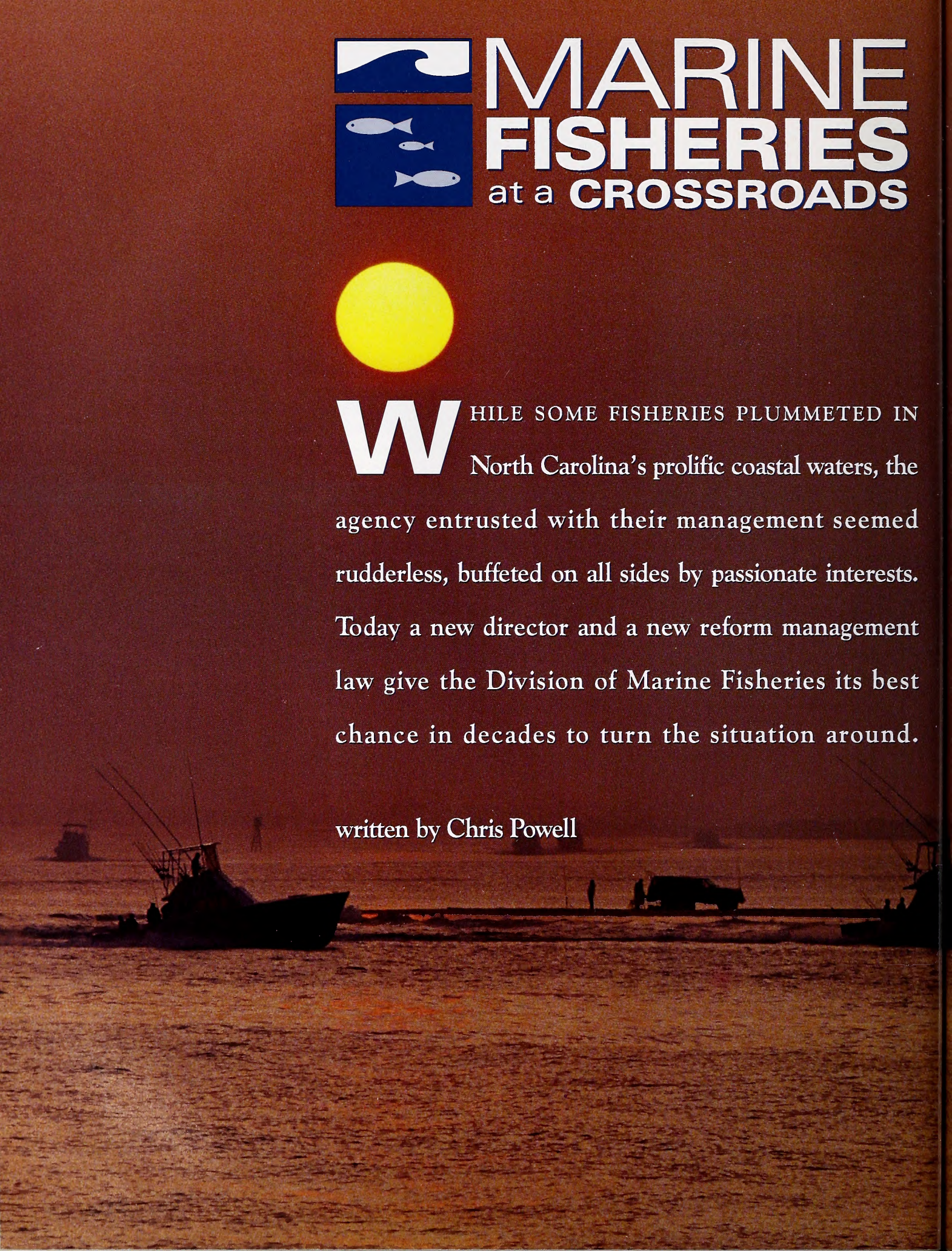


An herbivore's cheek *teeth (molars and premolars) have enamel ridges to grind vegetation. An omnivore's teeth have rounded cusps that are well adapted for chewing nuts and fruits. A carnivore's teeth are sharp and pointed for shearing flesh. All mammals chew with circular motions. Herbivores emphasize cross motions for grinding; predators emphasize up and down motions.*



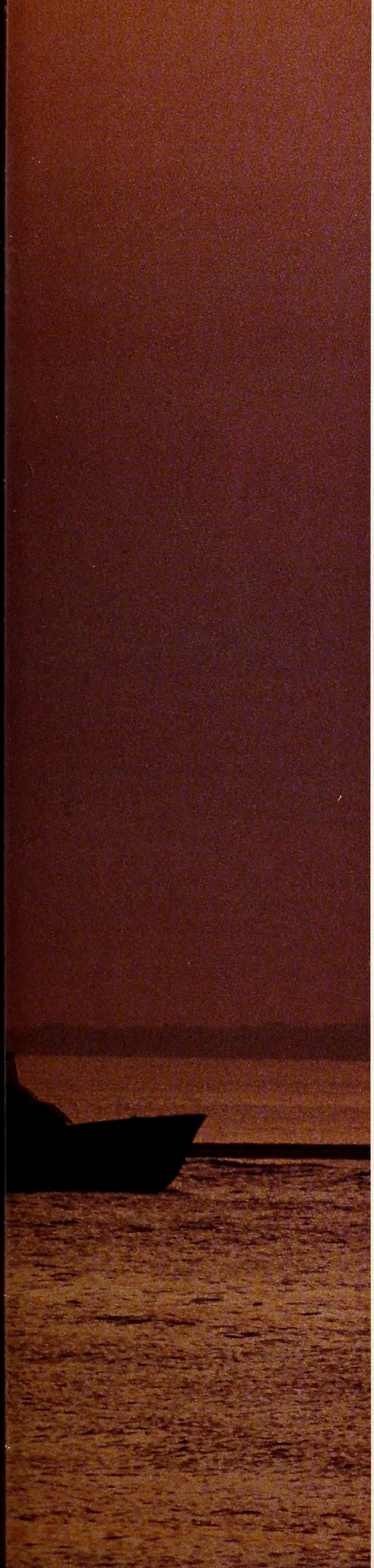
Eating is hard work. *Slowly, through an animal's life, chewing wears down the enamel on its teeth. A young animal has teeth with distinct contours for grinding or crushing or shearing. An old animal has smooth teeth, worn down by years of abrasion against food.*

MARINE FISHERIES at a CROSSROADS



WHILE SOME FISHERIES PLUMMETED IN North Carolina's prolific coastal waters, the agency entrusted with their management seemed rudderless, buffeted on all sides by passionate interests. Today a new director and a new reform management law give the Division of Marine Fisheries its best chance in decades to turn the situation around.

written by Chris Powell



JOEL ARRINGTON

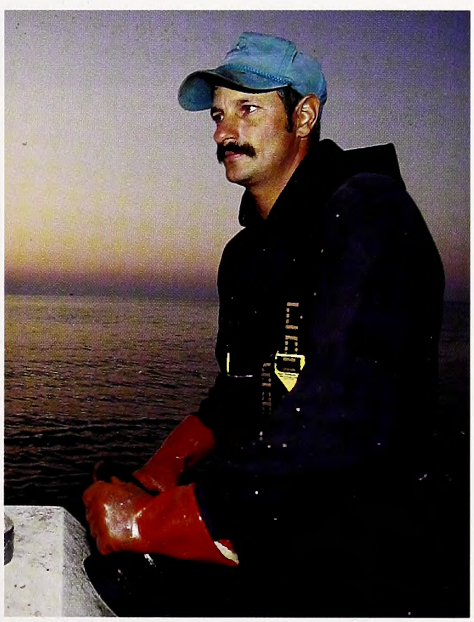
STORM WARNINGS

THE COMMERCIAL FISHING BOAT *YANKEE DAVE* SPUTTERED TO A start and within moments had its bow pointed toward another workday. Easing through the predawn light, the 24-foot Privateer picked its way from Holden Beach in Brunswick County to Lockwoods Folly Inlet. I stood beside Capt. Dave Beresoff, as we slid past the idle shrimp trawlers and ancient fish houses, and wondered if somewhere along the line I had made a wrong career choice. Juxtaposed with Beresoff's morning journey, my daily commute to a downtown Raleigh office was suddenly evident and colorless by comparison.

There is something simple and *real* about an income made from the sea. A commercial fisherman is connected to his or her surroundings on a level people like myself can never truly understand. A young netter or crabber might consciously study "toyds," weather and lunar cycles, while a seasoned waterman, after a life in the business, automatically interprets the surroundings, as if part of those elements.

The work can never be considered a career or job, but rather a way of life for those who subsist solely by its means. It is an all-encompassing vocation that lends itself to a sense of daily freedom and renewed opportunity. For Beresoff, who has earned an income from the water for 23 years, the life of a common fisherman is a historic link to the past that provides his family with a future.

Having a varied background in fisheries management, Beresoff possesses a perspective unique in the commercial fishing industry.



MELISSA McGAW

Dave Beresoff, Holden Beach commercial fisherman

MARINE FISHERIES at a CROSSROADS

"I believe, nowadays, the fellows who are willing to put in that extra effort are the ones who are going to survive."

—Dave Beresoff
Holden Beach commercial fisherman

MELISSA McGAW

***A broken net reel** motor isn't enough to keep Holden Beach commercial fishermen Erich McCall (left) and Dave Beresoff off the water. Instead, McCall manually turns the reel as Beresoff picks fish from the gill net.*

He studied marine biology for five years at Dowling College, on Long Island, before deciding that an eight-to-five job was not for him. During the early 1980s he moved from New York to Brunswick County, where he has earned a living by gill netting, crabbing and clamming. He has periodically worked with North Carolina Sea Grant, tagging Atlantic sturgeon as well as performing gill net selectivity studies that measure what effect the gear has on shark and sea mullet populations. At one time, he was a voting member of the N.C. Marine Fisheries Commission. And he recently was appointed to the N.C. Division of Coastal Management's Coastal Resources Commission. All of these extra activities reflect Beresoff's commitment to an industry that, for more than two decades, has defined his character.

"Without commercial fishing, I would feel like a square peg in a round hole," Beresoff said. "I am so acclimated to what I do. It's just like everything's second nature. I have intuition about certain things—that's something you have to build into yourself working on the water. Plus, every day is a new adventure. That aspect, that challenge is what I am looking for."

The work is dangerous, hard and unrelenting. There are no such things as weekends or vacations for those who must make their money when fish are around and weather permits. Each year, Beresoff has witnessed members of the Holden Beach fishing community teeter on the financial edge, then fall. And he adds that many have even had to resort to part- or even full-time jobs on land.

"I have noticed, particularly now that it's spot season, that there aren't as many people out there working, and that bothers me," said Beresoff, while pulling in a gill net on an October morning. "And that is because of the depressed spot market now. The low amount of money you can make forces you to do excessive volume to generate any kind of income."

It's the same story for most inshore and offshore watermen up and down the state's coast. About 3,000 people who subsist primarily by fishing are having to work increasingly harder to harvest enough catch to make ends meet. "I believe where it was a simpler life years ago, it was not hard to provide for yourself without extra effort," Beresoff said. "I believe, nowadays, the fellows who are willing to put in that extra effort are the ones who are going to survive."

Statistics indicate that many other commercial fishermen would agree. Between 1980 and 1993, the state's commercial finfish harvest wavered between a peak of 91.5 million pounds in 1980 and 46.4 million pounds in 1993. In 1997, however, the harvest jumped to more than 160 million pounds.

At first glance, increasing commercial harvests would appear to reflect healthy fish stocks. However, Dick Brame, director of fisheries for the N.C. Coastal Conservation Association, a group which promotes recreational fishing interests, believes the increases are a result of fishermen having to make more trips to set out more pots and more nets. "The classic sign of a collapsing fishery is harvests going through the roof," Brame said. "Fishermen direct more effort, more people and more gear until it collapses."

The added fishing pressure results in temporary gluts in the market that have forced watermen to respond in one of two ways. They can either set out more gear to pursue a larger quantity of undervalued fish or concentrate on species that are not as abundant and therefore higher priced. Obviously these market forces would lead to increasing harvests in the short term, but Louis Daniel, assistant to the director of the N.C. Division of Marine Fisheries, said the long-term effects could be catastrophic. That's because fishing takes a disproportionate number of older fish that are needed for breeding.

"Generally speaking, the larger and older fish of many species move more; they have opportunities to encounter more fishing gear; they are more competitive, meaning they are able to get to the baits faster," Daniel said. "When a fishery develops, you tend to see a reduction in the number of larger, older fish. In an underfished fishery, a fish

may live to age 10, whereas in an overfished fishery, the oldest fish may be 5 years old. Unfortunately, you lose some of the ecological integrity of your fishery because the oldest fish have the greatest amount of egg production and input into the replacement of the spawning stock biomass."

It is that age distribution among certain fisheries that has marine biologists worried. Though stocks may be relatively large in size, a lack of older breeding fish is the telltale sign of impending trouble. Of the 20 fish species for which Marine Fisheries has sufficient data, five have been classified as "depressed," four "stressed declining" and four "stressed recovering."

It would be easy to blame North Carolina's fishery woes on state and federal agencies that manage marine fisheries. But the fact is the Tar Heel State is in the grip of the same forces affecting declining fish stocks globally. Advances in technology have made fishermen too efficient at collecting the older fish, and pollution has severely damaged the primary and secondary nurseries needed for many younger fish.

Not long ago, a waterman would have had to be an expert at judging currents and wind directions to find the best fishing grounds. Now, commercial and recreational fishermen can obtain a Global Positioning System (GPS) and have instant access to what it took sea captains a lifetime to learn. Steel-hulled commercial work boats equipped with state-of-the-art technology can now work longer and smarter than ever before. When a paycheck depends on catching fish, it is not unusual for a commercial boat to resemble a marine research vessel staffed by amateur biologists. Radar allows navigation in any condition; sonars locate schools; satellite uplinks provide water-surface temperatures; and trawls, monofilament netting and longlines—adjustable for certain targeted species—do catch untargeted species as well.

But the finger of blame cannot be pointed directly to the commercial fisherman. A coastal population boom combined with disposable incomes have resulted in a substantial recreational fishing industry, too. Hard numbers are not available, but Marine Fisheries estimates the state has between 500,000 and 1 million recreational saltwater anglers. Bigger and better fiberglass boats as well as the advent of the reliable outboard motor have enabled more and more sportsmen to fish locations that would have been unthinkable 30 years ago. A punch of a few buttons, and a weekend angler can guide a recreational craft to within feet of a submerged structure. Sure, the commercial sector does harvest the majority of the annual finfish take (about 3½ times the recreational take), but no one can deny the effect thousands and thousands of single hooks can have, either. Catch-and-release studies indicate that 10 to 25 percent of fish returned to the water don't survive due to "stress, trauma, gut hooks, whatever," Daniel said.

Still, one of the biggest culprits, and often the most overlooked, is the pollution that filters daily into coastal estuaries. North

***A growing and** well-heeled coastal population has boosted the numbers of recreational fishermen in boats who are taking a toll on fisheries along with commercial fishermen. Below, a Brunswick County woman goes through the solitary business of gathering a few oysters from what was once the mighty North Carolina shellfish industry.*

JOEL ARRINGTON

MELISSA McGAW

MARINE FISHERIES at a CROSSROADS

Carolina's sounds have become the collection areas for contaminants ranging from treated sewage to runoff from highways, intensive livestock operations and fertilized lawns. A case in point is the decline of the once-mighty North Carolina oyster industry. Though the decline was initiated by the arrival of oyster trawls, loss of habitat and pollution were what ultimately drove the stake through the fishery's heart. (See "Twilight for Oysters," *Wildlife in North Carolina*, Nov. 1998)

Last summer, researchers at the University of North Carolina at Wilmington concluded a three-year study of the Albemarle and Pamlico sounds. What was found was "shocking," said Courtney Hackney, a biology professor at UNC Wilmington and the study's project manager. Nickel, arsenic, pesticides and various other contaminants were found in about one-third of the mud beneath the Albemarle and Pamlico sounds.

"We were very surprised at the extensive distribution of toxic materials," Hackney said. "We were expecting there would be some hotspots where we knew there would be industry. But we were very surprised about how far and how wide the contamination was and the impact in some areas where nothing was alive."

Reportedly, 13 percent of the estuary lacks bottom-dwelling invertebrates such as worms and shrimp, which constitute the bottom of the food chain. At least 37 percent of the surface-sediments were found to contain contaminants that could kill invertebrates. Also, 19 percent of the surface-sediments were found to contain three or more contaminants that could kill invertebrates. Contamination was most evident in the Neuse and Pamlico rivers and Albemarle Sound.

All of these trends, combined with a growing world demand for seafood, have put dark clouds on the horizon for fisheries and people like Dave Beresoff. Once, a Marine Fisheries patrol officer asked Beresoff if he would remove the numerous outdated commercial fishing stickers lining the port bow of the *Yankee Dave*. There being no law prohibiting the display of outdated stickers, Beresoff politely refused. Each of those stickers is a testament to 365 days of pulling pots, setting nets, paying bills and surviving. They are a source of pride that "let's people know I have been around," said Beresoff, cracking a weathered smile.

With marine fisheries management at a critical juncture, the question now is how many more stickers will be added to that bow? ◆

BEACON in the NIGHT

NEVER HAVE THE STAKES BEEN HIGHER FOR NORTH CAROLINA'S coastal fisheries and the people charged with managing them. Within the next few years, choices will be made that could determine the viability of numerous saltwater species off our coast. What lies in the balance is also the sink-or-swim future of the state's billion-dollar fishing industry. And the outcome will affect everyone from crabbers in Manteo to seafood lovers in Murphy.

Fisheries managers have reached this crossroads after weathering a number of tumultuous years. When Bob Lucas assumed chairmanship of the N. C. Marine Fisheries Commission in 1993, he found himself at the helm of an organization awash in public criticism. Total commercial fish harvests had dropped to half the 90-million-pound peak in the 1980s. The agency's fisheries management methods, later to be slated for complete overhaul, were under fire from recreational and commercial interests. Always somewhat contentious, the Marine Fisheries Commission had splintered, with sharp lines dividing the scientific, recreational and commercial representatives. Then leadership at the top began to buckle. Bill Hogarth, director of the Division of Marine Fisheries since 1987, resigned under pressure in 1995. Bruce Freeman, who succeeded Hogarth, shared a similar fate in 1997.

Much of the discord was due to the agency's crisis-by-crisis management style, which did not take into account input from user groups, said Lucas, who stepped down as chairman in 1997.

"The regulatory process was taking place on a piecemeal basis," Lucas said. "In other words, in one particular regulatory cycle, the commission may have talked about trawling. In the next cycle, we may have talked about crab pots. There was no real rhyme or reason

MELISSA McGAW

"The moratorium was an effort to get a snapshot of where we were, and an effort to preserve...the status quo while we came up with a plan."

—Bob Lucas
former chairman of the N.C. Marine Fisheries Commission

to what we were trying to do.

"We had no advisory committees; the fishermen really weren't involved much. You would go to public hearings and they would say things like, 'Who came up with this idea?' It was a very confrontational management process."

Convinced Marine Fisheries' methods were irreparably flawed, Lucas and a supporting cast pushed for a revamping of how the agency does business. But making effective changes would not be easy for a variety of reasons. North Carolina has a complex geographical composition unlike any other area on the East Coast, meaning management plans could not be modeled after other states'. Inshore, North Carolina's shallow system of sounds is so large a boat can lose sight of land. Offshore, the Gulf and Labrador currents converge off Cape Hatteras, giving North Carolina unique access to warm- as well as cold-water species. Then there are always the schools of fish that travel up and down the coast, presenting state management consortiums with a constantly moving target.

Further complicating the matter was the commercial industry's revolving door of participants. Seasonal fishery cycles cause some people to jump in and out of the business, creating a nightmare for biologists trying to monitor catches. That's where the 1994 fisheries moratorium came in. The moratorium placed a temporary cap on commercial fishing licenses, which previously had been available to anyone willing to pay the fee. A proposed 500-participant "pool" of licenses was proposed during the moratorium and will go into effect in July.

"You can't have effective management when the number of commercial fishermen is always changing," Lucas said. "So the moratorium was an effort to get a snapshot of where we were, and an effort to preserve, the best we could, the status quo while we came up with a plan to make things better."

The moratorium steering committee went to work drafting what would become the Fisheries Reform Act of 1997. The central thrust of the act was to develop fishery management plans by nailing down exactly how many recreational and commercial fishermen were harvesting the resource. Proposals called for accomplishing this by two methods. First, a cap would be placed on the number of commercial fishermen allowed to sell their catch (about 7,500). Second, saltwater anglers would be required to purchase a fishing license, which would help biologists more accurately gauge the recreational impact. Ultimately, the recreational license didn't survive the legislative process. But most of the act's components did, and the groundwork was laid for a new era in saltwater fisheries management.

SCOTT TAYLOR

***These commercial** fishermen were able to corral a nice school of spot with their 700-foot haul net. Because some of the most valuable fisheries are down, many commercial fishermen have had to target the least valuable fish like spot and croaker. But the brown pelican above doesn't seem to mind.*

The reform act mandates that fisheries management plans gradually begin going into effect between the summer of 1999 and 2003. The creation of the plans represents a substantial philosophical shift for Marine Fisheries. Instead of addressing problems as they arise, the plans will take a holistic approach to maintaining a viable resource. And rather than simply limiting the user groups, the plans will allow the agency to influence gear types, prohibit fishing locations, tailor plans for multiple species, address habitat issues and garner support for the proposals.

"This new fishery management planning process gives us the ability to solicit public comment by developing citizen advisory councils. The councils will then help staff develop recommendations for the different management measures," said Louis Daniel, assistant to the director of the Division of Marine Fisheries. "It also allows us to take those recommendations to public hearings and try to get public acceptance of the management process."

The plans will differ by design, but each will be based on an "optimal yield" management system, as opposed to a "maximum sustainable yield" approach. Both methods can be compared to managing fisheries like a personal bank account. As a fish population spawns, it produces younger fish, much like a bank account draws interest. But to withdraw from an account on a regular basis, fishermen must not dip into the interest-accruing principal.

"Let's say you have a population of 1,000 fish, and let's say that population increases during a year by 10 percent," Daniel said. "The overall population would be 1,100 fish, so you can take out 100 fish—your 'maximum sustainable yield.' But you can see the problem you run into if, unknowingly, stocks begin to decline from natural causes. So to be risk averse, you take out only 80 a year.

"So by using an approach of 'optimal yield'—hedging your bets as you move

through the process—the overall loss to your fish stocks is going to be less and much more conservative. That is really the way we are required under the Fisheries Reform Act to manage our fisheries," Daniel added.

Optimal yield is largely a reaction to an economic theory known as "The Tragedy of the Commons," popularized by biologist Garrett Hardin in 1968. Hardin believed that uncontrolled use of a public resource for profit would inevitably lead to that resource's destruction. He illustrated his point by supposing that 10 herdsmen each have one reindeer grazing on a pasture that can support no more than 10 animals. The problem occurs when one herdsman decides to add an extra reindeer. The result is less grass for the total herd, which becomes undernourished and therefore devalued. Of course, the herdsman with two animals realizes a profit increase. The other herdsmen, facing shrinking profits, are forced to either sell out or add more animals of their own. The process of "mutual overexploitation" continues until overgrazing destroys the pasture, and all of the herdsmen are driven out of business.

"The Tragedy of the Commons" is also applicable to fishing for profit. Without specific restrictions, a gold-rush atmosphere takes over, with people fishing harder, longer and smarter. After all, what's the sense of voluntarily reducing your fish harvests if the spared schools are just going to be swept up by the next boat?

Such was the case with the North Carolina crabbing industry, which brought the moratorium issue to a head in the early 1990s. To maintain their traditional harvests, crabbers started a virtual arms race of crab-pot buying. One crabber would set out more pots, and the other crabbers would have to match or beat that number, and so on. The problem became so bad that a group of crabbers went to the Marine Fisheries Commission and requested restrictions on themselves—a move previously unheard of in commercial fishing circles.

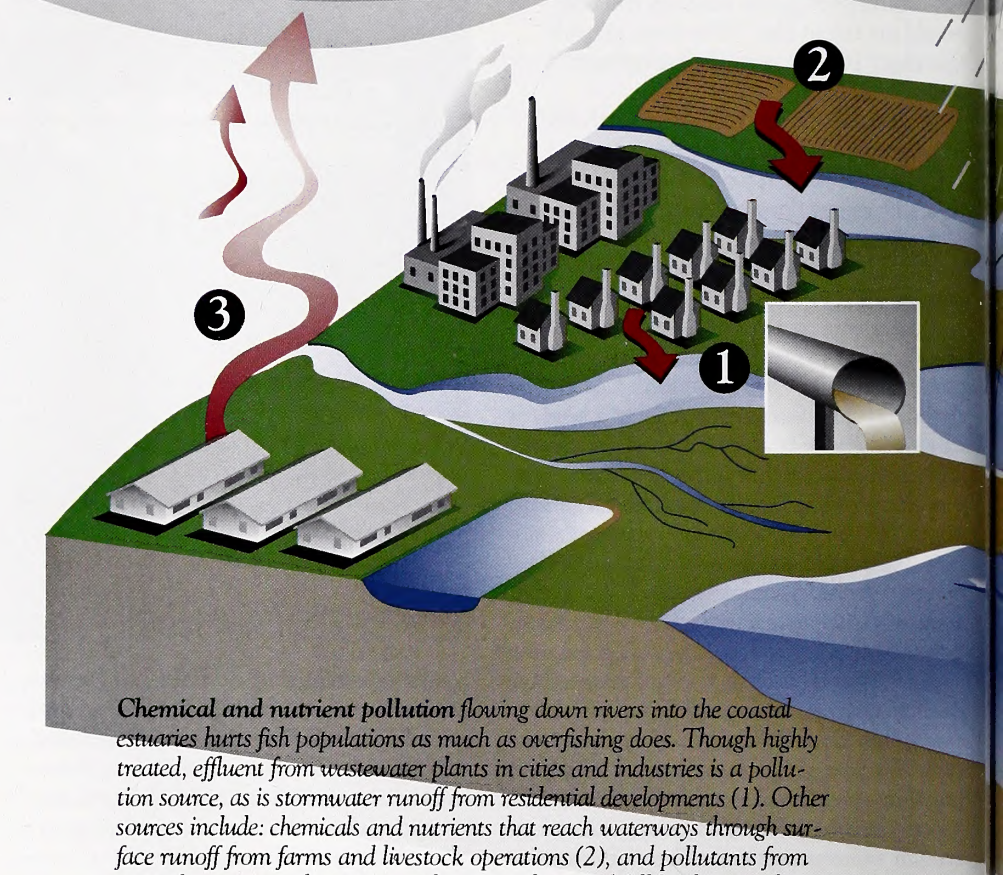
"What started this whole moratorium is crab pots," said Dick Brame, director of fisheries for the N.C. Coastal Conservation Association. "The crabbing industry used to have about 300,000 crab pots, and now there are in excess of 800,000, and the overall catch is the same. What that means is that if you used to fish 200 crab pots, now you have to fish 800 to catch the same number of crabs. The problem is if you cut back to 200 and the other guy's got 800, you aren't going to have comparable catches. But if everybody went back to 200, no one would really be hurt and, in fact, they would make more money per pot."

Jerry Schill, president of the N.C. Fisheries Association Inc., said there is no clear consensus among commercial crabbers regarding a pot limit or limited-entry system. Even so, the commercial fishing lobbying organization is opposed to the proposition. "By and large, [our group] is not enamored of a limited-entry system or a pot limit," Schill said.

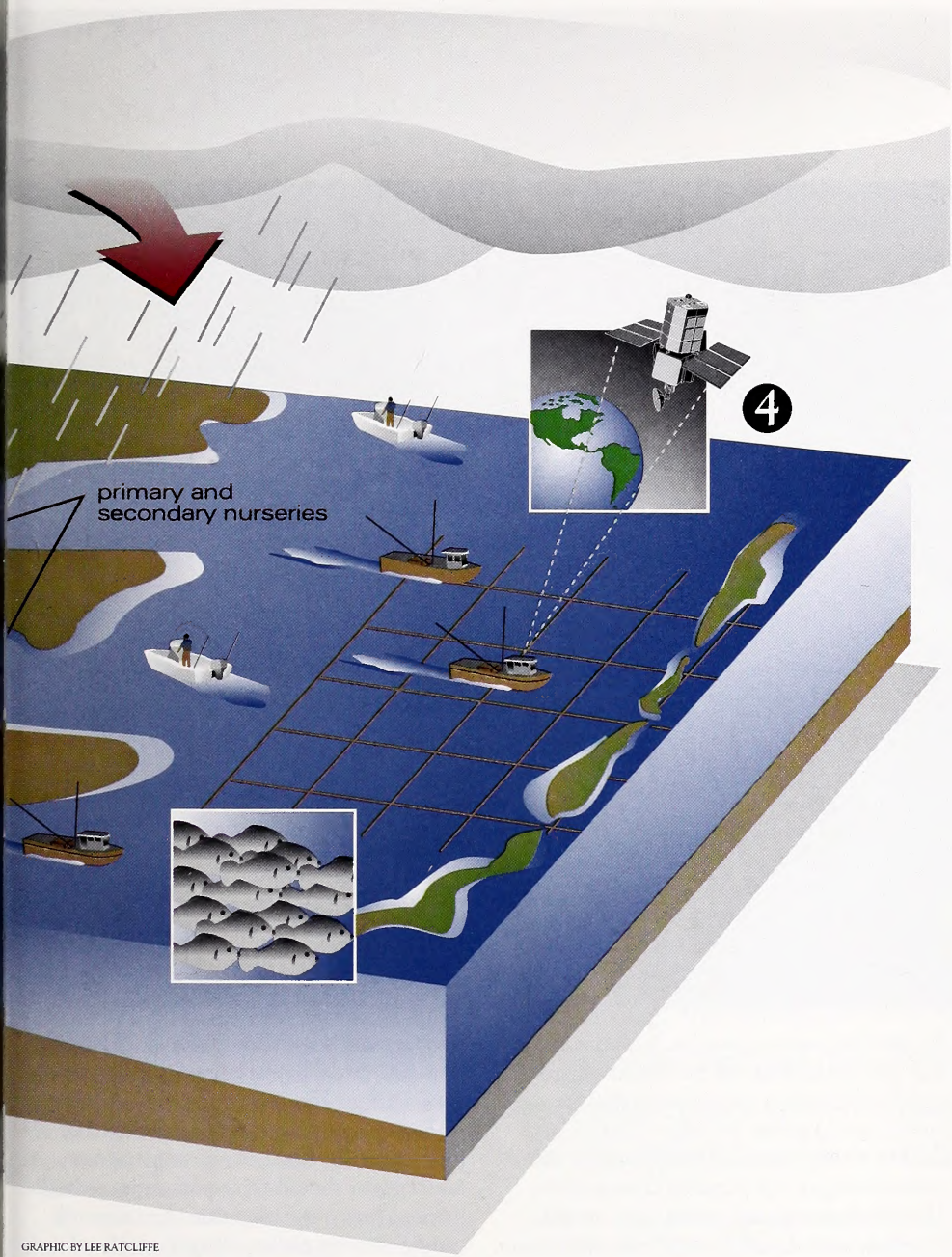
Dave Beresoff, a Holden Beach commercial fisherman and part-time crabber, is also opposed to a limit on pots. He thinks a crabber should not be limited to a set daily potential. Moreover, Beresoff believes the law would be unenforceable. "What are they going to do, go around and count the number of pots a man sets each day?" Beresoff said. "A man is limited to what he can do, and I feel that is the best way to manage the number of pots."

Because blue crabs are the state's most profitable fishery (worth more than $38 million in 1997), the General Assembly mandated that the first management plan should address crabs. Scheduled to go into effect July 1, 1999, the proposal stops short of a pot limit but does suggest a myriad of other management techniques. Among other things, the plan would prohibit commercial gear in selected areas, disallow the possession of certain male peeler crabs dur-

WHAT'S STRESSING OUR FISHERIES?



Chemical and nutrient pollution *flowing down rivers into the coastal estuaries hurts fish populations as much as overfishing does. Though highly treated, effluent from wastewater plants in cities and industries is a pollution source, as is stormwater runoff from residential developments (1). Other sources include: chemicals and nutrients that reach waterways through surface runoff from farms and livestock operations (2), and pollutants from animal operations that rise into the atmosphere and fall back to earth as nutrient-enriched precipitation (3). New fishing technology has also hastened the overall decline of fish stocks. Using Global Positioning Systems (4) that rely on satellites, recreational as well as commercial boats can navigate to the best fishing grounds and quickly locate fish.*



GRAPHIC BY LEE RATCLIFFE

Sources: N.C. divisions of Air Quality, Water Quality and Marine Fisheries

ing their June-through-September breeding period and establish rules to protect blue crab habitat. The plan also calls for the establishment of a maximum allowable bycatch (non-targeted species caught unintentionally) of crabs by shrimp trawls.

In addition, fishermen holding recreational licenses for commercial gear would not be allowed to use commercial crab trawls. However, they would be permitted up to five pots per person or vessel. Individuals setting pots from private shorelines or docks could set up to two pots.

All of these crab management options will be brought before the Marine Fisheries Commission in May for a final recommendation.

While Beresoff believes the plan could be effective, he believes it may not have gone far enough by allowing people with recreational commercial gear licenses to set pots and use other forms of commercial gear. People with a recreational commercial gear license are permitted to use commercial gear to harvest seafood, provided it is only for personal consumption.

"You can't just allow anyone who purchases a recreational commercial license to have pots," Beresoff said. "The plan closes off one end with commercial restrictions but opens another end with the recreational use of commercial gear license. It defeats the purpose."

The recreational use of commercial gear has been a sticking point since the start of

The N.C. Division of Marine Fisheries' jurisdiction encompasses all coastal waters and extends to three miles offshore. Agency policies are established by the nine-member Marine Fisheries Commission and the secretary of the Department of Environment and Natural Resources.

HIGHLIGHTS of the FISHERIES Reform Act of 1997

- The act established a new standard commercial fishing license at an annual cost of $200 for residents and $800 for non-residents. The commercial fishing license allows the holder to harvest fish, crabs, shrimp and shellfish. Before this, a special license was required to harvest crabs, shrimp and shellfish.
- Only fishermen who have held an Endorsement to Sell will be eligible for the new license. A cap will be placed on the number of Endorsements to Sell equaling the number in existence on July 1, 1999. Currently there are approximately 7,500 such licenses.
- The act established a recreational commercial gear license for fishermen who want to use commercial gear to catch seafood for their own consumption. The cost will be $35 annually for residents, $250 for non-residents. The license prohibits selling of the catch.
- The Marine Fisheries Commission decreased from a 17-member board to nine members, all appointed by the governor to serve staggered terms of three years.
- Beginning July 1, 1999, the Division of Marine Fisheries must begin implementing plans for all commercially and recreationally significant species. Reviews of each plan will take place every three years.

Courtesy of the N.C. Division of Marine Fisheries

MARINE FISHERIES at a CROSSROADS

MELISSA McGAW

MELISSA McGAW

***Whether or not this** boy will be able to continue the crabbing tradition is still very much in question. By the early 1990s, the number of crab pots being set exploded, forcing crabbers to work harder to make their former catches. Underscoring the economic importance of this shellfish, the General Assembly mandated that the first fisheries management plan will address blue crabs.*

the fisheries reform process. It is an issue that gets to the heart of the debate regarding the conflicting recreational and for-profit use of a public resource. North Carolina has a long history of letting people use commercial gear for personal consumption. The privilege originally started as a means by which coastal people could fish commercially for food. But unlike most East Coast states, North Carolina has allowed the license to become a way by which almost anyone can harvest a quantity of seafood.

Proponents of the recreational commercial license believe they have a right to take from the public resource just as the commercial sector does. Their worry is that a ban on recreational use of commercial gear would end activities like setting a net for a church fish fry or family crabbing, clamming and oystering outings.

On the other hand, commercial fishermen, marine biologists and a growing number of anglers argue that the license allows too many people to take from a limited resource. Moreover, they say it puts destructive gear into the hands of about 15,000 amateurs.

"Recreational use of commercial gear should not exist because the tools of my trade are not toys," Beresoff said. "I believe that 100-yard gill nets being available to any Tom, Dick or Harry is wrong."

Brame agrees with that sentiment, but feels that the effects of recreational commercial gear should be accurately measured before a ban is put into place. Because fish caught recreationally cannot be sold, information is lacking as to the actual effects these practices have.

"Commercial gear is not recreational," Brame said. "It is intended to kill a lot of fish efficiently. There is nothing sporting about it. On the other hand, we have very little data on the commercial-recreational harvest effort, which is the reason for the new license. The Marine Fisheries Commission needs the data from this sector in order to act in a rational manner."

The debate also touches on another management method that looms like a sea monster in the future of optimal yield plans—limited entry. This potential management method controls fishing pressure by allowing only certain people to harvest specific fisheries. However, limited entry is considered to be a very last resort, despite the wishes of some conservation groups.

"What we hoped the Fisheries Reform Act would do is provide for a much smaller but professional commercial fishery," said Brame, who supports limited entry. "I think one of the failures of the reform act is it will let anybody with an Endorsement to Sell to catch and sell fish." (An Endorsement to Sell allows licensed commercial fishermen to sell their catch.) "Of the roughly 7,500 fishermen with endorsements, only about 2,500 sold over $5,000 worth of fish last year. Our universe of commercial fishermen in this state is under 3,000, yet we are going to allow 7,500 endorsements to sell."

But what criteria would be used to decide who could fish and who could not? Some watermen fear that politics and a limited-entry system would cut out the small-time or semi-retired fishermen, leaving the most profitable species for the bigger outfits. Limited entry has so much potential for controversy, the General Assembly has withheld that choice for itself.

A quota system may be a more likely alternative for managing many fisheries. Quotas simply allot a predetermined poundage of fish to a user group. "Let's say we can take 1,000 pounds of weakfish (gray trout) out of a population," Daniel said. "If the commercial fishery has traditionally landed 80 percent of the weakfish, then we would give 800 pounds to the commercial fishery and 200 pounds to the recreational fishery. We would monitor those catches and when they both added up to 1,000 pounds, we would shut the fishery down."

Quotas could also be taken a step further by allocating the poundage among individual commercial fishermen or boats. This would remove much of the competition for the resource and allow captains to time their trips when markets, fishing and weather are most favorable.

Even so, many commercial fishermen are wary of quotas they fear will limit their ability to better themselves financially. "The keystone of fisheries reform was for the fisheries management plans to be holistic rather than crisis management," Schill said. "What I see is the commission spending an inordinate amount of time on issues that have nothing to do with conservation and everything to do with allocation."

On the opposite end of the spectrum, Brame supports the reform process because of the emphasis on control measures.

"To have a sustainable fishery, we have got to limit effort," Brame said. "We can't let everybody fish whatever way they want to. The way you limit recreational fishing is by bag limits and size limits, and you limit commercial fishing either by a quota or a limited-entry system."

Restrictions will undoubtedly play a large role in the reform process, but they won't be the only means to an end. Plans to protect coastal habitat are also being developed. The Reform Act establishes that certain state agencies will collaborate to serve the coast and its tributaries. Those agencies include Marine Fisheries, the Division of Coastal Management and the Division of Water Quality. In addition, the N.C. Wildlife Resources Commission has been asked to serve formally and informally on some of the advisory committees.

As the fisheries reform process comes into focus, one thing is clear: There are no easy solutions. What makes fisheries management so difficult is the human element. If recreational and commercial fishermen didn't take from the resource, species would balance themselves naturally. And who would care what shape a fishery is in? But obviously this is unrealistic. Marine biologists have the unenviable task of manipulating fisheries not simply for biological ends, but for social and economic ends as well. It is a daunting challenge, but one Marine Fisheries may have never been more prepared to accept. ◆

TAMING the TEMPEST

IT'S RARE, THESE DAYS, TO SEE TRUE ACTS OF COURAGE, ESPECIALLY when a paycheck is involved. Pres Pate could have easily cruised through the remainder of his successful career with the N.C. Division of Coastal Management. But when the N.C. Division of Marine Fisheries directorship opened up in 1997, he bucked conventional wisdom and took one of the most controversial jobs in state government.

After a short period as head of the Division of Marine Fisheries, Pate has dramatically improved morale at the once-beleaguered agency. He has also accomplished what many of his predecessors could not by garnering simultaneous support from the commercial and recreational fishing industries.

"I like Pres Pate; I think he's doing an excellent job," said Jerry Schill. "He can be seen just about everywhere. If the only time to meet a group of fishermen is 6 a.m. for breakfast, he will be there."

Dick Brame shares that opinion: "He is an excellent manager, he is a fair person, and he wants the science to be right. That is all you can ask."

And if Pate hasn't brought these two warring tribes completely together, they now are at least sitting at the same table. It would be easy to think of Pate as the man on the white horse who, at the last minute, rode in to save the day. But anyone who has met him knows he doesn't view himself in those terms. If anything, he could be compared to a shrewd investor who saw an organization turning the corner after a down cycle. He cashed in his profession and reputation and bet the lot on an agency most had given up for dead. Now, a year and a half later, he is riding a groundswell of public support and is poised to pull off a feat that could significantly influence the future of marine fisheries in North Carolina.

In order to comprehend Pate's gamble, one must take into account that his previous coastal management experience was no pleasure cruise. He was responsible for regulating the development of privately owned coastal property, making himself a frequent lightning rod for criticism. In fact, it has been said that he was one of the few candidates for which the Division of Marine Fisheries directorship would be a less controversial position. Even so, Pate initially had his doubts.

MARINE FISHERIES at a CROSSROADS

MELISSA McGAW

***Pres Pate, director of** the N.C. Division of Marine Fisheries (left), and Louis Daniel, assistant to the director of Marine Fisheries, represent a new spirit of innovation and cooperation at the once beleaguered agency. Pate has also been able to garner support from commercial and recreational interests.*

"...in following the drafting of the Fisheries Reform Act, I saw a lot of positive potential for improving fisheries."

—Pres Pate
director of the N.C. Division of Marine Fisheries

"I really didn't think a whole lot about pursuing the position because of the controversy that had swirled around the division for a long time and all the acrimony that had developed between the recreational and commercial fishermen," Pate said. "But in following the drafting of the Fisheries Reform Act, I saw a lot of positive potential for improving fisheries. It was a time in my life when I was looking for a change to reinvigorate myself professionally and finish out my career as a state employee."

If Pate has his way, future Division of Marine Fisheries management will be a much more collaborative process. One of his first orders of business was to establish an open-door policy for agency staff, which he then carried over to the recreational and commercial user groups.

"I think anytime that you are working within a regulatory program that sets rules and affects the way people make their living or enjoy their recreation, you have to make the people you are affecting a part of that process," he added. "The credibility that your stakeholders have in your decisions, I think, is directly proportional to the belief the stakeholders have that they are being listened to."

Historically, Marine Fisheries' ear has been bent toward the commercial sector. Until 1965, the agency was even called the Division of Commercial Fisheries. Now, however, the pendulum has swung, and the recreational sector is uniting to have the loudest voice of all.

Much of this new influence is due to the sheer numbers and spending power of rec-

reational fishermen. But the potential saltwater recreation fishing license, which many feel is certain, could lead to the group's biggest flex of muscle. Withdrawn from the 1997 Fisheries Reform Act, the license could be passed by the General Assembly this year. "I think it is inevitable that we have it," Pate said. "It is just a matter of when."

The proposed license had called for a $15 annual fee for people 16 or older, a $5 one-week license for visitors and a $250 lifetime license. Special provisions would also have been available for the elderly, handicapped and less fortunate.

Marine biologists support the license because they say it will provide far more accurate recreational landing data than their present system. Currently, biologists rely on port samplers who perform dockside surveys and random phone surveys.

"It is a guess now that our recreational user group is somewhere between a half million and 1 million participants, and that is an unacceptable margin of error from a manager's standpoint," Pate said. "You need to know what impact that component of the fishery is having on the stock before you can make a fair allocation of the resource to that user group. And right now, I think our information about the recreational harvest in North Carolina certainly has room for improvement."

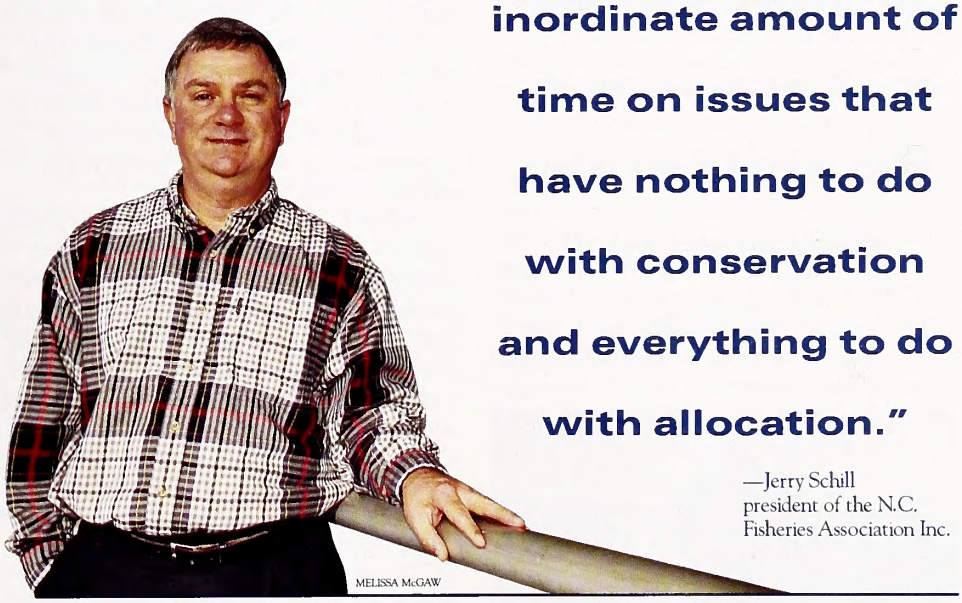
Some anglers argue that a saltwater license would essentially end the state's last free outdoor sporting activity. However, a growing number of recreational fishermen support the license because of the potential for generating revenue. Senate Pres. Pro Tem Marc Basnight has suggested that any recreational license fees be put into an endowment fund (like the Wildlife Resources Commission's endowment fund) from which only the interest could be used for conservation programs. The money would then be allocated by a board of trustees that would include recreational fishermen, which is what has watermen so worried.

The proposed recreational license places commercial fishermen, ideologically, between the devil and the deep blue sea. On the one hand, watermen feel they are severely regulated with licenses and restrictions, while the recreational fishermen go virtually unnoticed. On the other hand, a saltwater license could give a million anglers a major stake in fisheries management, and that's enough to turn the heartiest sea captain a little green. Commercial fishermen fear that the money would be used to fund studies that would call for bans on commercial fishing. This fear could be justified.

In states such as Louisiana and Florida, the creation of recreational licenses has eventually led to net bans. Tim Nifong, who holds the Marine Fisheries Commission's scientific

"What I see is the Commission spending an inordinate amount of time on issues that have nothing to do with conservation and everything to do with allocation."

—Jerry Schill
president of the N.C.
Fisheries Association Inc.



MELISSA McGAW

SCOTT TAYLOR

***Many recreational** fishermen would like to see shrimp trawling in coastal waterways eliminated because of the number of fish taken as unintentional bycatch. Marine Fisheries officials believe that with proper management there is room for inside trawling.*

MARINE FISHERIES at a CROSSROADS

"Ultimately to have a sustainable fishery, we have got to limit effort. We can't let everybody fish whatever way they want to."

—Dick Brame
Director of Fisheries for the N.C. Coastal Conservation Association

MELISSA McGAW

seat, believes the net bans in other states resulted from animosity between the user groups, and he fears it could happen here.

"We'll simply see payback," Nifong said. "The commercial industry has had an exclusive right to a public resource for a long time. It's not that we can't sustain a viable commercial fishery; I think we should and for a lot of reasons. The question is: Are we going to *allow* commercial fishing to survive? And the backlash is the biggest thing that scares me."

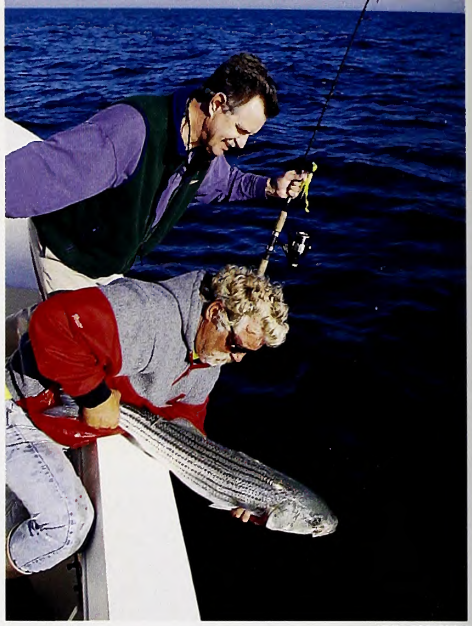
But it may not have to be that way. Pate believes North Carolina could be immune to the economic and political forces affecting commercial fishing in other areas. The reason, he said, is that North Carolina's sounds and offshore fisheries are so diverse that the two industries can coexist, if managed properly. And while bycatch levels remain a concern, Pate believes there are misperceptions about fish caught unintentionally by commercial gear.

"If you look at a species-by-species breakdown of the bycatch of fish, you will see it is primarily spot and croaker, which are very abundant in North Carolina and have a very high natural mortality rate," Pate said. "It is not a fair perception to say that if those fish were not caught as a part of that commercial activity, they would grow up to be big fish that could be caught on hook and line."

The same applies to misperceptions regarding inshore trawling, which some states have completely restricted. Already in North Carolina, bottom-disturbing gear (like trawls) is prohibited in most primary nursery areas, and secondary nurseries where there is an abundance of finfish.

"You can't compare the commercial fishery in North Carolina to that of South Carolina, Florida or Georgia and say that a closure of certain fisheries here would be as successful or as easily absorbed as in other states," Pate said. "People say, 'Virginia doesn't allow any inshore trawling.' Well, Virginia doesn't have any shrimp. We have three species of shrimp that are very abundant and valuable in North Carolina, and harvest of those by trawl is the predominant way to do it."

Sure, the potential for recreational catches would be enormous if commercial fishermen didn't harvest their yearly average of 48 million pounds. Conversely, commercial catches would likely be somewhat larger if recreational coolers weren't filled with 15 million pounds per year. But who is to say which group is entitled to the resource. The reality is that both are woven into the fabric



JOEL ARRINGTON

***With striped bass** harvests nearly decimated by 1980, strict bag and size limits were established, sparking a rapid population rebound. The fishery was declared "recovered" as of 1997, representing one of the state's greatest fish management success stories.*

of North Carolina's heritage and economics. And as such, the sight of surf fishermen and weathered shrimp boats will likely both be here for a long time.

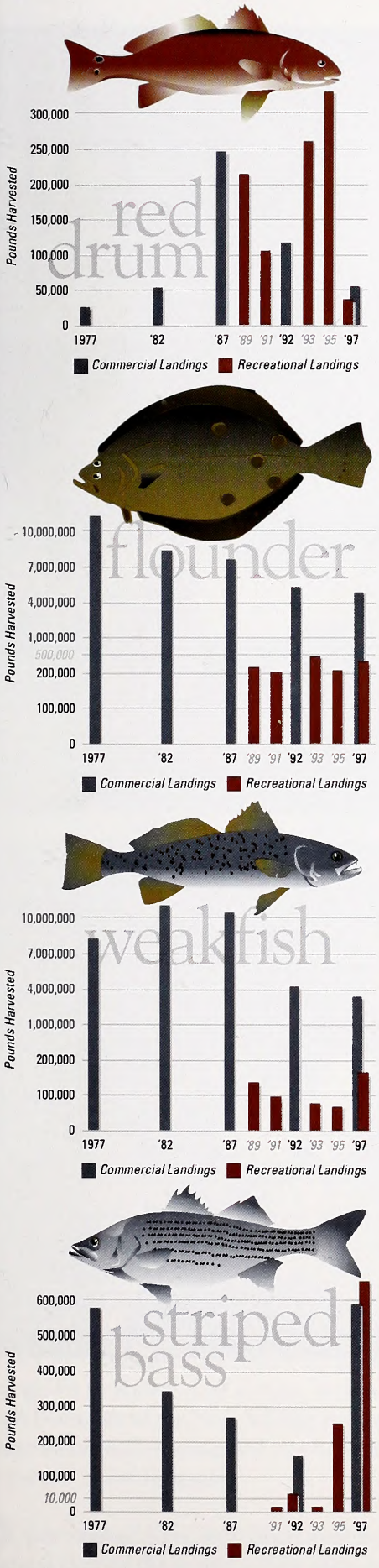
Aiding that future coexistence will be the 1997 Fisheries Reform Act and the management plans created under it. Using flexible methods of gear and area restrictions as well as limits, marine biologists hope to manipulate species populations in a manner that is socially as well as economically feasible. And already, the future looks very bright for a number of species that were declining.

In the 1980s, striped bass populations were all but decimated. However, by working in conjunction with the Wildlife Commission, Marine Fisheries was able to suspend striper harvest, sparking a rapid population rebound. The fishery was designated "recovered" as of 1997 and still stands as one of the state's greatest management success stories.

That same aggressive technique was suggested in the early 1990s for the dwindling summer flounder stock. Instead, managers opted for a more gradual process.

"We have allowed summer flounder harvest to continue, spreading the recovery process out over a number of years," Pate said. "And we may still be four or five years away from complete recovery."

Another fishery showing promising signs is the red drum—North Carolina's state fish. The red drum, also called a channel bass, is somewhat indicative of many saltwater species off our coast. While their numbers are



GRAPHIC BY LEE RATCLIFFE

Source: N.C. Division of Marine Fisheries

plentiful, red drum are considered to be in danger because so many are immature. The fish can live up to 60 years and don't spawn until they are 4 years old and about 30 inches long. To help these stocks mature, the Marine Fisheries Commission set new restrictions on the fishery in 1998. The recreational limit was reduced from five fish per person per day to one. Also, fish shorter than 18 inches and longer than 27 inches must be released. In addition, a 100-pound-per-trip limit was established for commercial vessels.

All of these restrictions were needed despite the presence of very large schools of puppy drum (immature red drum). This is what makes managing recovering fisheries, such as red drum, so difficult. Fishermen see the large schools and think restrictions are no longer necessary. However, it is quite the opposite, Pate said.

"We characterize that species as 'stressed declining' at a time when, by anecdotal accounts, there are more red drum in the sounds than people can remember in a long time," Pate said. "These 18- to 27-inch fish seem to be literally everywhere. But that doesn't mean the stock is necessarily healthy. Once you look beyond that age group, mature male and female spawning stock are not as numerous as they should be by comparison to the historical age structure of the red drum species."

The same applies to rebounding weakfish stocks, which were the source of heated debate during the early 1990s. To comply with a federal fisheries management plan, the Marine Fisheries Commission imposed a ban on the use of fly nets south of Cape Hatteras. The ban, combined with additional gear restrictions and recreational bag and size limits, has resulted in an age structure increase for the last three years, said Louis Daniel, with the Division of Marine Fisheries.

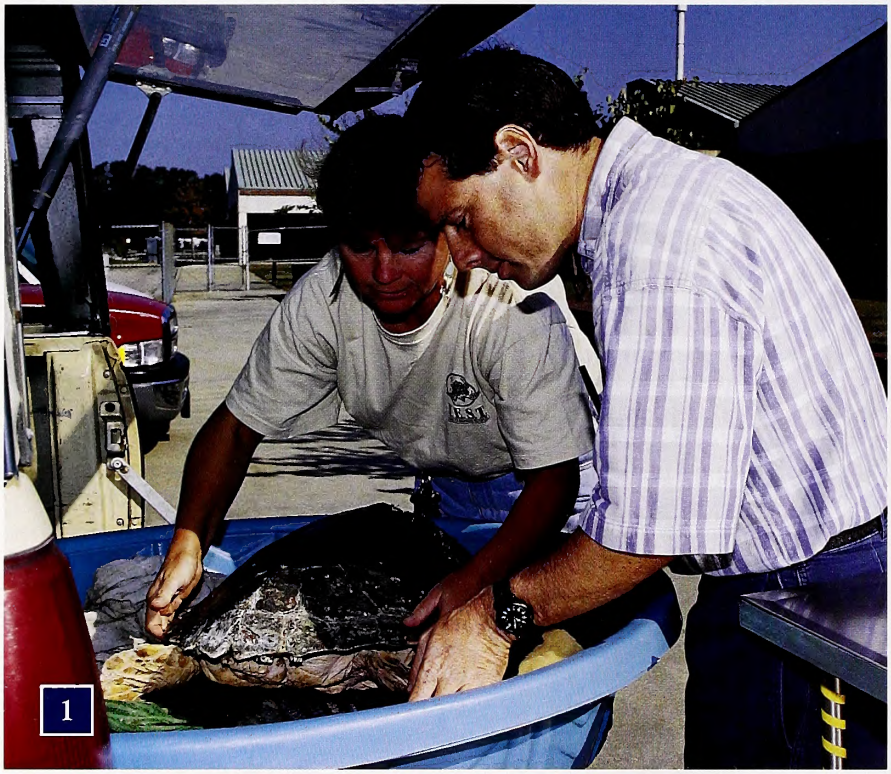
"Weakfish live to be about 15 years old," Daniel said. "When I started working for Marine Fisheries four years ago, the fishery was so heavily overfished it was rare to find a fish coast-wide older than four years. Every year since, harvest restrictions have permitted an increase in the age and size structure of the weakfish. We are now seeing fish 8 years old!"

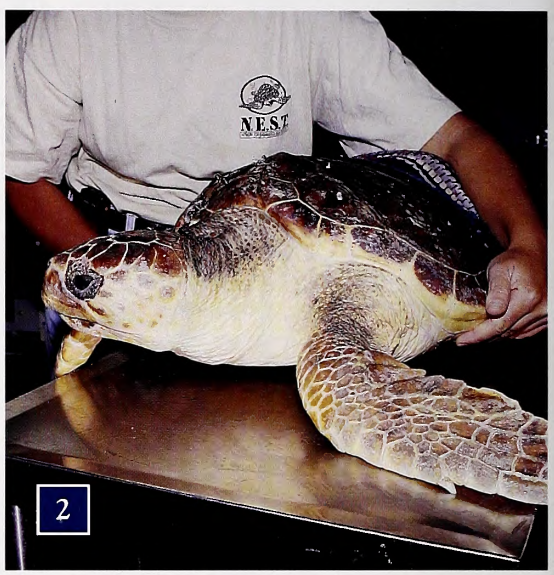
There is cause for optimism regarding the status of our marine fisheries, but there is also equal cause for concern. Because while stocks are relatively plentiful, many are immature and lack the means to bounce back from heavy fishing pressure. It seems contradictory, but when fisheries have the most potential is also when they are the most vulnerable. That is why the reform measures being drafted during the next few years will be so crucial. The plans represent the state's best attempt to ensure fisheries remain viable along our coast. But for the management efforts to work, they will need time. And that is something Marine Fisheries, under Pate's command, should be able to buy a lot of. ⊠

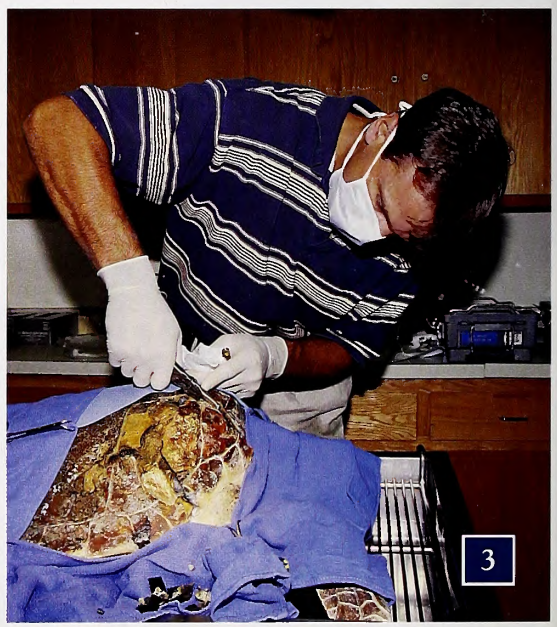
A transcription of the Pres Pate interview is available on the Wildlife in North Carolina *web site. Address: http://www.state.nc.us/Wildlife/ConservationEd/winc/pate.htm.*

SCOTT TAYLOR

Close Call for *Kitty*







It was touch-and-go for the injured loggerhead sea turtle after it was maimed by a boat. Today, Kitty's on the mend at the Topsail Turtle Hospital, a first-class rehabilitation center for stranded and injured sea turtles.

photo story by Melissa McGaw

1 Its name was Kitty. At least that's what volunteers with the Network for Endangered Sea Turtles (NEST) called the injured loggerhead sea turtle when they found it stranded on a Kitty Hawk beach in May 1997. Classified as a threatened species under the Endangered Species Act, a stranded loggerhead sea turtle with an open wound is cause for concern. Kitty was immediately transported to N.C. State University's College of Veterinary Medicine in Raleigh for treatment. Left to right, biologist Ruth Boettcher of the N.C. Wildlife Resources Commission and veterinarian Greg Lewbart prepare to move the turtle.

2 Vets weighed Kitty, took blood samples and cleaned the wound as best they could. Stranded loggerheads are typically juveniles, with years of breeding ahead of them. Despite nearly 70,000 loggerhead nests in the Southeast, most hatchlings will never reach maturity. Thus each turtle is important to the recovery of individual nesting populations.

3 Kitty suffered fractured bones apparently from a boat collision and returned to the Vet School several times for surgery. On her second visit to Raleigh in June 1997, veterinarians stabilized her torn shell and broken bones with wires and screws.

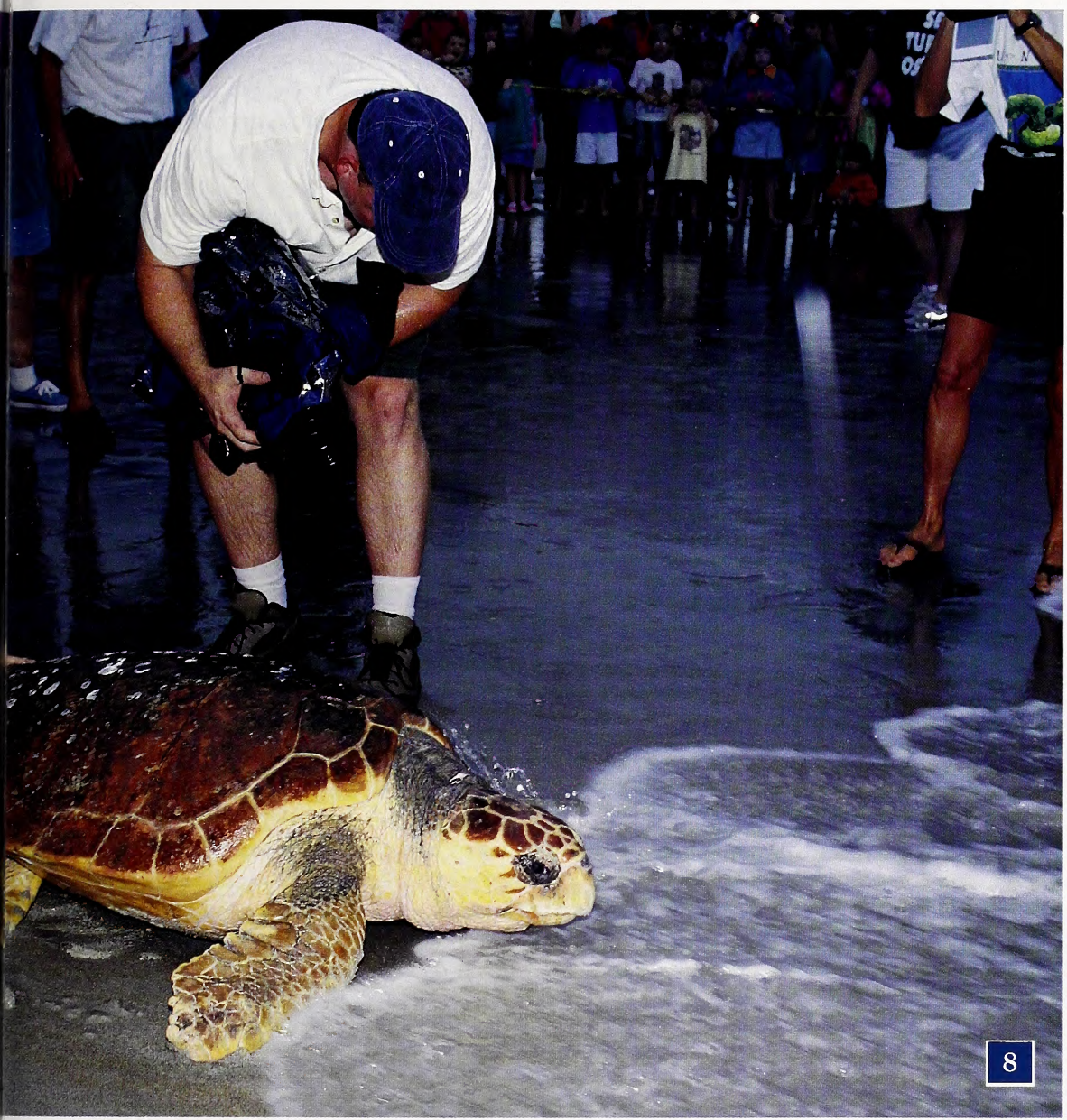
4 During several surgeries, veterinarians anesthetized Kitty and surgically removed dead tissue and small pieces of bone. In time, cartilagenous tissue covers the injured area and grows into healthy bone.

teers Millicent Self, Jean Beasley (the hospital's founder), Sharon Dermott and a veterinarian student look on. The hospital volunteers play an important role in restoring injured turtles to health by feeding them, cleaning their wounds and changing dressings.

5 After the surgical procedure, surgeons drilled screws into Kitty's shell and reattached wires tautly to stabilize the carapace.

6 After her second surgery in June 1997, Kitty was returned to the Karen Beasley Sea Turtle Rescue and Rehabilitation Center on Topsail Island for rehabilitation. This unique holding facility is totally staffed by volunteers. Here, Dr. Andy Stamper of the Vet School checks Kitty's healing, while, from left to right, volun-

7 The recovery of sea turtles in North Carolina is being accomplished by a network of devoted people that include volunteers with the Topsail Turtle Hospital and the Network for Endangered Sea Turtles, nongame biologists with the Wildlife Commission, and personnel with the North Carolina Aquariums. The Veterinary School at N.C. State University offers services to seriously injured sea turtles. Here, Drs. Andy Stamper, Greg Lewbart and Oscar Ramirez confer on a radiograph.



8 The biggest day in the life of an injured sea turtle is its return to the sea. This large loggerhead, nicknamed Corey, is given an affectionate pat by Jean Beasley at its release at Topsail Island last June. Two loggerheads and a Kemp's Ridley sea turtle were released on the same day. Kitty's wounds have healed so well that its release is scheduled for this spring. Since the Topsail hospital's founding in June 1997, volunteers have treated and released 10 turtles.

9 Scientists using satellite transmitters are tracking the post-release movements of some sea turtles. You can follow the lengthy migrations of these turtles by connecting to the web site of the South Carolina Department of Natural Resources. Address: http://www.dnr.state.sc.us/marine/turtles.html

If you find a stranded or injured sea turtle, call your local police department, the closest North Carolina Aquarium or 1-800-682-2632. Or call Sea Turtle Project Coordinator Ruth Boettcher with the N.C. Wildlife Resources Commission at (252) 729-1359.

NORTH CAROLINA NONGAME & ENDANGERED WILDLIFE FUND

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Wildlife is a gift often taken for granted. Please return it. The Nongame and Endangered Wildlife Program is dedicated to conserving native wildlife of North Carolina. Lend your support to this effort through a tax-deductible contribution on your North Carolina income tax form or send your contribution today to Nongame and Endangered Species, N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27604-1188.

Winter's Last Gasp

Man eats ramp. Man meets skunk. The ingredients are ripe for a wintry showdown on a snowy mountain.

written by Doug Elliott ©1999
illustrated by David Williams ©1999

It was the middle of March, a few years back, and winter was all but gone. Here, on the southern edge of the Blue Ridge in Rutherford County, we hadn't seen a flake of the white stuff the entire winter. Now I'm not the sort of person who would complain about a mild winter, but I just had a hankering to tromp around in some snow. Maybe it's my part-Yankee blood showing through, but it just doesn't seem like I've had a winter if I don't get into a little snow.

My favorite is a good tracking snow that's not too deep or powdery, with just enough moisture in it to leave a good imprint. Following an animal's trail adds an extra dimension to a winter hike. I love trying to decipher the stories tracks in snow can tell. But if I can't get a tracking snow, any snow will do.

A cold front was blowing in from the northwest. There was no snow in our forecast, but some accumulation was predicted for the higher elevations. This might be my last chance. If the snow wouldn't come to me, I figured, I would head for the snow. I drove up into Avery County to roam the forested slopes and grassy balds of the Yellow Mountains.

Even though spring flowers were in bloom at home, here on this mountain only 60-some miles away (and 3,000 feet higher) there was, indeed, a blizzard blowing. The ground was already covered and there was more coming down—glorious, blustery winter weather: just what I came for. With the snow accumulating like it was, I knew my chances of finding animal tracks were slim, but on the other hand, if I did find any today, they would be fresh.

After wandering up the slope a ways, I noticed some familiar-looking dried stems and the tightly rolled tips of green leaves poking up out of the snow. Ramps! Those odiferous, flavorful wild leeks that mountain folks are so fond of gathering in spring. I had gathered plenty of them in late April and May but I had no idea that they first appeared in March. I scraped away the snow and unearthed a few. The leaves were tightly compacted. Each plant measured no longer than 3 or 4 inches from the pale white bulb to the pointed green top.

I wiped them off in the snow and munched a few right there on the spot. They were crisp and tender—about as mild as a ramp could be—but *Whoa*! That hot, musky, powerful, oniony garlic flavor still made my eyes water. Young as they were, these babies packed a wallop!

I kept on climbing up through the woods, reveling in the snowy bluster and munching more ramps as I went. Then I came upon a set of tracks. Some kind of short-legged mammal had recently waddled past. I could discern fingerlike toes, but they were not very clear because the rapidly accumulating snow was filling them in. I backtracked a ways.

Following an animal's trail backward can tell you as much as following its direction of travel. Also, I wanted to postpone disturbing the critter as long as possible while I learned more about it. I found places where it had cleared the snow away and nibbled greens. With its waddling gait, fingerlike toes and veggie diet, this had to be a groundhog. It had been eating primarily the tiny young leaves of waterleaf and fringed phacelia. These two plants are in the family *Hydrophyllia-ceae*, and they are edible by humans, too. Some traditional mountain folks call waterleaf "leather britches," and they cook it along with dandelion, branch lettuce and other wild greens to make a tonic and nutritious wild "sallet" that might serve as a side dish to a plate of fried ramps. Later in May, phacelia carpets the floors of high Appalachian forests with millions of delicate white flowers. With its mild flavor and its creeping foliage that stays green all winter, phacelia is probably an important food for many herbivores. In this same area four months before, I crept close enough to a grouse to watch it feeding. Phacelia was one of its primary foods that day.

I continued following the tracks back until they led into a dense thicket, then I turned around and decided to follow in the direction the groundhog was traveling. This led me to a hole. The tracks went in and came out, then ambled over to a seepy area covered with young greens, where the snow was not so deep and there were a number of cleared areas where the groundhog had been feeding. Then the tracks led off down the hill at a gallop—sets of four, a foot or two apart, bounding like a squirrel, until they disappeared into a burrow in the ground. These tracks were fresh. I realized that I had interrupted the animal's snowy meal. The groundhog had seen or heard me coming and dashed for shelter.

I spent the rest of the day wandering all over those wintry mountain slopes. As I was heading down I came upon another set of tracks. These were similar to the groundhog's but narrower and smaller. I followed them down through the woods until they came out to an open,

mowed meadow. At this point, the snow was blowing sideways, and the surrounding mountains were lost in dim whiteness. I pulled my cap down and my scarf up around my face in a vain attempt to keep the snow from blowing in behind my glasses. The tracks meandered about in the field. I followed along totally fascinated, wiping my glasses as I went. Here and there were small holes and fresh dirt where the animal had been digging.

"Could this be a skunk?" I wondered. "Yes," I gasped. In fact, there the skunk was, not 30 feet away. It was ambling along, vigorously digging at the edge of grass clumps and rooting about. I had been so absorbed in my tracking and the skunk was so focused on its food gathering that I had nearly walked right up on the critter, and neither of us knew the other was there. The skunk was busy hunting grubs, ants and other hibernating insects, as well as an occasional vole or mouse. With the snow accumulating as it was, this was the last chance for a short-legged critter to easily dig up some food until the snow melted. Skunks do not actually hibernate, but they will "lie up" in their dens for several days at a time during severe weather.

I stopped right there in my own tracks and ever so slowly hunkered down. With the animal so close and still unaware of me, I remembered that opportunities like this were the reason I was carrying my camera with the zoom lens. I eased my pack off my shoulders and somehow extracted the camera without alerting the skunk. I focused, zoomed in as close as I could get, and fired off a couple of shots as the animal worked its way across the field, coming closer and closer. The gusty wind was blowing in my face as I watched the skunk pass below me on the slope.

It was about 15 feet away when suddenly it looked up and stared right at me. Its nose nervously probed the air. With one eye in the viewfinder and one eye peeking over the top of the camera, I froze like a statue while the skunk stared at me long and hard. Skunks have poor vision, and in this shadowless, dim light, if I could hold still enough I might escape detection and pass as an inert (if slightly weird) part of the landscape. The animal would never catch my scent with this wind blowing. And if I could get the camera focused and unfogged at the same time, I might even be able to get a half-decent photo.

Never taking its eye off me, the skunk slowly and suspiciously lifted its tail. Then suddenly it started bounding in my direction. I couldn't believe what I was seeing (split image though it was). A charging skunk! And not only that, it was charging at me! I frantically tried to adjust my focus for the rapidly shortening distance between us. I held my ground (and my breath) while my adrenaline ran wild. The skunk ran right up to me, and mercifully it came to an abrupt halt 5 feet away.

I could see it squint its beady black eyes and sniff again. With the wind blowing, it still couldn't smell me and had no clue as to my identity. Then it whirled around and ran off a few yards, circled around to my left side and ran up to me again. Once more it sniffed, but the wind was still strong and blowing from the side this time, so the skunk still could not get a whiff of my human scent. Then it ran off again. This time it circled around, up the hill, until it was directly downwind of me. It stood up on its haunches and sniffed again. Being directly downwind this time, it caught my scent with both nostrils. That poor astonished critter shook its head and snorted. A shudder seemed to run down its body. Then it whirled around, ran off through a blackberry thicket and dove into a burrow.

I guess the moral of the story is: Eat enough ramps and you can beat a skunk at its own game. ⊠

"Skunks have poor vision, and in this shadowless, dim light, if I could hold still enough I might escape detection and pass as an inert (if slightly weird) part of the landscape."

Doug Elliott is a naturalist, an herbalist and a storyteller. For a list of his upcoming programs or a catalogue of his books and recordings, send a self-addressed stamped envelope to Doug Elliott, 3831 Painters Gap Road, Union Mills, N.C. 28167.

Some of North Carolina's brightest teachers of the future embark on a five-day learning adventure each summer to study the effects of air pollution on our beleaguered mountains.

written by Rodney Foushee
photographed by Ken Taylor

Standing atop the concrete and stone observation tower on Mount Mitchell, it's easy to feel as if you're on top of the world. The clouds streak below as high winds buffet your face. At 6,684 feet, Mount Mitchell is the highest peak in eastern America.

"It's gorgeous," exclaims Sunshine Phillips, a sophomore at the University of North Carolina at Asheville, her beaming young face aptly reflecting her name. Surrounding mountains and valleys appear briefly and then fade with the next wave of cool, moist clouds.

But something is missing this August morning atop Mount Mitchell, as it is on many southern Appalachian peaks—something that young eyes, though keen, don't have the experience to notice. Though nearby landmarks are still visible, distant peaks and valleys are mostly obscured by haze. Far from natural, this haze is not caused by humidity but rather results from the sulfur discharge of dozens of coal-fired power plants and industries located hundreds of miles away. There was a time when, on a clear summer day on Mount Mitchell, you could make out towering Clingman's Dome, straddling the Tennessee line some 70 miles away in the heart of the Great Smoky Mountains National Park. Now, it's hard to view Asheville just 20 miles away.

And it's not just the mountain visibility that's affected by human pollution. Airborne nitrogen compounds spewed from utilities, industries and millions of cars form a corrosive, acidic cloud that coats the Appalachian soils and streams, killing trees and fish. Another by-product is ozone—formed when nitrogen oxides and other chemicals from car exhausts are exposed to sunlight. Though ozone in the upper atmosphere protects us from harmful ultraviolet rays, ground-level ozone is harmful to humans and plants. This smog causes breathing problems, especially for children, the elderly and those with breathing disorders such as asthma. Ozone also interferes with plants' ability to store energy and makes them more susceptible to disease, insects and other pollutants. The stark remains of dead spruce and fir trees on Mt. Mitchell—trees living only 20 years ago—stand as proof of the insidiously destructive power of air pollution.

Sunshine and the 15 other college students standing above the clouds on Mount Mitchell this summer day are not here just for a school field trip. These are some of the state's brightest future teachers. And they are here for a five-day workshop to learn as much as they can about the environment of the southern Appalachian Mountains—especially the problems caused by air pollution—and carry this information, as well as possible solutions, back to the classrooms of the future.

With the theme "Five Mountains in Five Days," the N.C. Wildlife Resources Commission has teamed up with the U.S. Environmental Protection Agency for the

FIVE MOUNTAINS

FIVE DAYS

***The breathtaking views** of the southern Appalachians are too often obscured by haze (above) from manmade sources including coal-fired power plants and industry. Some of North Carolina's brightest future teachers (inset) are learning about the effects of air pollution on our mountains and some possible solutions during a workshop co-sponsored by the Wildlife Commission.*

past four years to sponsor this advanced environmental education workshop for future teachers. In five days, the students will visit some of the Appalachians' highest peaks—Chilhowee Mountain, Clingman's Dome, Mount LeConte, Mount Mitchell, Grandfather Mountain—in search of knowledge about the environment. All of the participants are from the North Carolina Teaching Fellows Program, which consists of an outstanding group of college students who each receive a full scholarship at one of 14 state colleges or universities when they agree to teach in North Carolina public schools for at least four years after graduation. Acceptance into the program is difficult, requiring high academic standards. All 400 high school seniors accepted in the Teaching Fellows Program each year must graduate in the top 10 percent of their respective high school classes. (See "N.C. Teaching Fellows Program," p. 27.)

But the key to the success of the mountain air-quality workshop is that it is totally voluntary. "Each of these students has given up an entire week of their busy summer because they truly want to learn about the environment," said Anne Hice, the Wildlife Commission education specialist who helps organize the workshop.

The adventure begins in Cades Cove on the Tennessee side of the Great Smoky Mountains National Park. Here the students camp in tents, cook their own meals and learn about the effects of air pollution on the half-million-acre park and its wild

inhabitants. The students are paired up and given field experiments to work on. These range from conducting vehicle counts to determining emissions, surveying lichens and other pollution-sensitive organisms, and taking direct measurements of water and air quality. Their findings will be presented at the end of the week.

To view the devastating effects of acid rain and ground-level ozone on the forest, students fly over portions of the Smoky Mountains in a small airplane to get a first-hand look at the impacts of pollution. The dead and dying trees are proof of the effects of the invisible menace. The students also visit the park's Look Rock Air Quality Monitoring Station to learn how scientists are monitoring the air quality of the Smokies. Despite its seemingly pristine nature, the Great Smoky Mountains National Park suffers from some of the worst air pollution in the country. Blame it on bad location—the park lies downwind from the highly industrialized and populated Tennessee and Ohio River valleys. This one-two punch of industrialization blankets the park with tons of smog and other airborne pollutants each year. And the problem is getting worse.

Last summer alone, the air in the park exceeded the safe level for ozone on a record 44 days. On many of the Smokies' ridgetops, the ozone level is twice as high as that in the most congested urban areas of Atlanta and Charlotte. Besides damaging human lungs, ground-level ozone also damages the leaves of some 30 plant species in the park, including yellow poplar and black cherry trees.

Average annual visibility in the park has dropped from about 93 miles to 22 miles, with visibility averaging just 12 miles in the summer due to haze from sulfur dioxide. And the effects of acid rain and other acidic deposits from air pollution in the Smokies are just as dramatic.

"We have the highest levels of acid deposition in North America," said Jim Renfro,

The dead and dying *trees atop Mount Mitchell (left) are one of the most visible signs of air pollution in our mountains. Acid rain and other air pollutants, along with an exotic insect, have taken their toll on the high-elevation forests over the past 20 years. Participants in the mountain air quality workshop spend a busy five days learning about the environment including (inset photos, from top to bottom): 1) testing the acidity of the soil, 2) installing nest boxes for wildlife, 3) surveying tree growth on Mount Mitchell, and 4) using lichen abundance as an environmental indicator.*

the park's air resource specialist. Tons of nitric oxides are deposited on the mountains each year from air pollution. "This acidifies the streams and soils, which can damage trees and fish," Renfro said. "It also alters the soil and water chemistry."

Rainfall in the park is on average five to 10 times more acidic than normal rainfall and sometimes approaches concentrations 100 times higher than normal due to air pollution. But it is the acidic clouds themselves that cause the most damage and carry the strongest punch, depositing concoctions more acidic than vinegar into the fragile high-elevation trout streams and spruce-fir forests. These destroy aquatic insects and other food for native brook trout. They also leach nutrients out of the soil causing some plants, including red spruce trees, to take up toxic levels of aluminum and other heavy metals.

There are many strategies to lessen the impacts of air pollution in the Smokies, including recycling, new technologies and conserving energy, but all begin with reducing emissions and eliminating additional emissions. In a step in the right direction, North Carolina recently joined Tennessee in an agreement with the U.S. Department of the Interior to allow federal officials to review future industrial development projects that may have an impact on the air quality of the Great Smoky Mountains National Park.

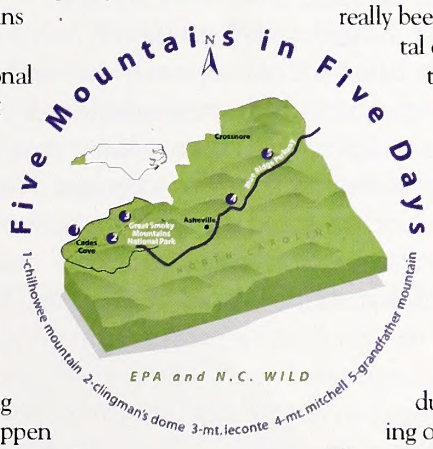
The hands-on educational workshops of the Teaching Fellows are invaluable in the battle against air pollution, according to Renfro. "The only solution to this problem is to reduce air pollution," he said. "Awareness of the impacts of the pollution is the first step toward solving the problem. It will not happen overnight, but we can overcome this problem. As more people learn about the issue, they will discover that the benefits of clean air outweigh the costs of reducing pollution. It just takes people being concerned."

After leaving the park, the students head to Grandfather Mountain to learn about the effects of air pollution and other human impacts on animal species.

"I concentrate on habitat because I think it is important for these students to understand the total picture in the mountains," Hice said. "It is not just the air-quality problems in the Smokies. Many plant and animal species have declined or disappeared in the mountains because of habitat changes caused by humans."

Besides forest clearing, human impacts include the introduction of the chestnut blight, which virtually wiped out the American chestnut—a major food source for wildlife—in the early part of this century. More recently, acid rain and the introduction of the balsam woolly adelgid—an exotic insect—have combined to weaken and destroy Fraser firs on the highest mountain peaks.

"Since the Industrial Revolution there have been huge changes in forest types in the Smokies," Hice said. "But we haven't really been monitoring environmental conditions in the mountains for very long. The lack of visibility and the dying of the trees in the past 20 years have really brought out the need for environmental monitoring and concern."



The findings of the students' monitoring projects are presented during a mock town meeting of "Tox City" to explore ways to reduce air pollution in the fictional town. Various ways to reduce emissions are proposed and discussed, including mass transit, curfews on automobile use and new pollution-reduction technologies. But the students are forced to examine the costs of cleaner air in the debate, as some are assigned to represent the interests of developers and business leaders.

Though no simple solutions to air pollution are reached, all of the students take away lasting memories and lessons from their week in the mountains.

"The only true way to learn is to experience things for yourself," said Crystal Davis, a junior from N.C. State University who plans to teach environmental science when she graduates. "If I can carry back some of these lessons to the classroom, my students will be able to make informed decisions about the environment."

For most of the participants, the workshop was an eye-opener. "I really had no idea how serious the air pollution was in the mountains," said Michael Armstrong, a sophomore education major at the University of North Carolina at Asheville. "I think people take clean air for granted and focus on the water and the land. That's probably a mistake."

Because air pollution can seem elusive unless you can actually see its effects, the EPA puts a special emphasis on air quality education, including funding the Teaching Fellows workshop.

"We try to focus on air-quality issues as much as possible," said Donna Rogers, environmental education coordinator for the EPA's Office of Air Quality Planning & Standards. "We're willing to fund this project because it gives these students firsthand experience in the outdoors and exposes them to the problems and challenges of air quality. They can see the effects of acid rain and ozone for themselves." Both the EPA and the Wildlife Commission provide the future teachers with plenty of educational materials that they can use when they reach their first classroom.

"The rewards of this workshop are realized when the students' enthusiasm is kindled for environmental education," Rogers said. "That enthusiasm is coupled with a greater appreciation for the environment and a sense of confidence to teach these complex issues. The goal of promoting environmental awareness and stewardship will be realized through the energies of these bright young teachers."

Who knows? With enough emphasis in our classrooms placed on protecting North Carolina's rich natural heritage, our children might one day be able to view Clingman's Dome from Mount Mitchell on a summer day. ⊠

N.C. Teaching Fellows Program

The N.C. Teaching Fellows Program was enacted by the state in 1986 to recruit talented high school graduates into the teaching profession to ensure quality education and leadership for the classrooms of the future. The program provides a full four-year scholarship to 400 outstanding Tar Heel high school seniors each year. Participants are challenged to think beyond the classroom through various summer workshops and field trips across the state. In exchange, the students agree to teach for four years in one of North Carolina's public schools.

The Wildlife Resources Commission sponsors two week-long summer workshops for Teaching Fellows including a coastal ecology workshop held at Oak Island in May and the mountain air quality workshop in August. There is no cost for the students for either workshop, but space is limited.

For more information about the Teaching Fellows Program, call (919) 781-6833. For information or to register for upcoming workshops, call Wildlife Commission education specialist Anne Hice at (336) 674-6152.

When you encounter an animal you think may need your help,

What Should You Do?

written by Buffy Silverman / illustrated by Consie Powell

Spring is the perfect time of year for watching wildlife. Birds begin to raise their families. Frogs croak, calling for mates. Turtles move over land, looking for places to lay eggs. Squirrels, raccoons and rabbits are busy caring for newborn babies.

What should you do when you find a young animal that appears to have been abandoned? When should you help an animal? In most cases, wild animals are best left alone, for babies that seem to have been abandoned seldom are. Use the opportunity to learn about animals by observing them, preferably from a distance.

A baby bird is on the ground under a nest. Should I put it back in the nest?

If the baby bird is very small, with only a few feathers, it may have fallen out of the nest. It's all right to put the bird back if you can reach the nest safely. Birds do not have a sense of smell, so they will not know that one of their **nestlings** has been touched by a person. They will still take care of it. If you find the same youngster on the ground again, leave it alone. Sometimes adult birds push out a weak or sick nestling that has little chance of surviving. It may be sad for us to see a bird die, but death is part of the natural world.

If you find a well-feathered young bird hopping on the ground, leave it alone. **Fledglings** can not fly well, but they follow their parents and beg for food. The fledgling's parents are probably nearby and will come to take care of their youngster when you are gone.

Will I get warts if I pick up a toad?

A toad's skin is dry and warty, but a toad cannot give you warts. It is perfectly safe to pick up a toad, but be prepared: it may wet your hand. It does this to defend itself—often an animal will drop a toad when it urinates. Make sure you don't drop the toad.

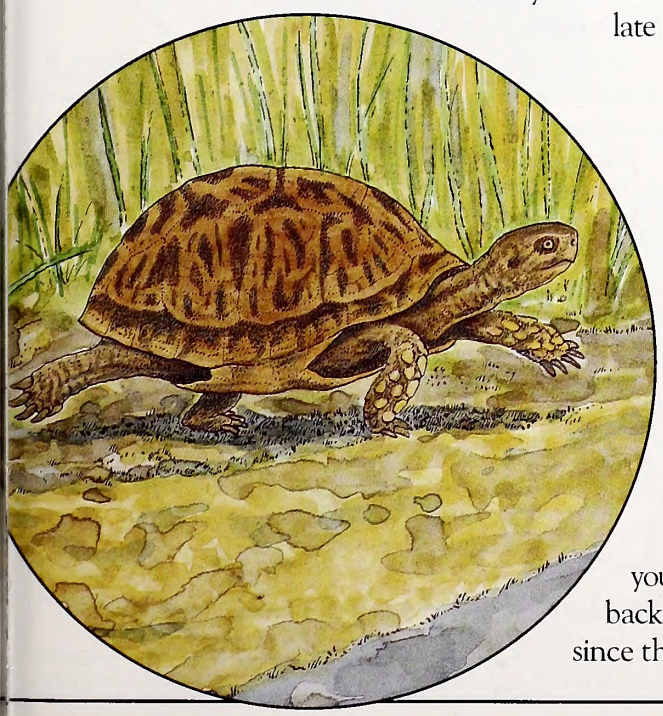
Toads have other ways of defending themselves from predators. Look for the large bumps, or **glands**, behind a toad's eyes. If an animal tries to eat a toad, the toad secretes a poison from these glands. Some animals learn to avoid toads if they get sick from the poison.

I found a nest of baby rabbits under a bush. Their eyes are closed and their mom is nowhere in sight. What should I do?

Leave the babies alone—their mom will return to care for them. A mother rabbit leaves her babies in a nest lined with fur, shredded leaves and grasses. She returns each dawn and dusk, uncovers the nest and lies over it to let her babies nurse. She stays with them for only a few minutes, then finds a nearby place to rest and feed. After 16 days, the young leave the nest and are on their own.

I spot a fawn lying by itself in a thicket. What should I do?

Leave the fawn alone. Its mother will return; she has gone off to feed herself. You have sharp eyes. The spotted fawn is well hidden and safe in the thicket, blending in with shadowy branches and lying motionless. It will stay with its mother until late fall or winter.



I saw a turtle crossing my road. Should I help it across?

Turtles cross roads when looking for a place to dig a nest and lay their eggs or when searching for better habitat. When baby turtles hatch, they move from land to water, and may also have to cross a road.

Most turtles are safe to handle, but don't pick up a snapping turtle. It has a long tail, a short temper and can extend its flexible neck to reach and bite a person holding it.

If you help other kinds of turtles cross the road, make certain you carry the turtle in the direction it was traveling, or it will head back onto the road again. Wash your hands after handling turtles, since they can carry **salmonella**, a bacteria that can make you sick.

Help! A snake is slithering through the grass. What should I do?

Take a step back. Relax. Watch the snake from a comfortable distance. Is the snake flicking its tongue to "taste" the air? Is it basking in the sun? Does it move towards a bush or other hiding place? If you have a notepad with you, make a quick sketch of the snake, noting its color and pattern. Try to identify the snake you drew with a field guide when you go inside.

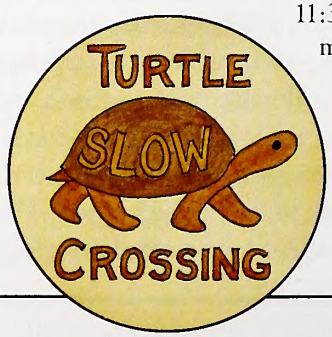
Most North Carolina snakes are not **venomous**, but even harmless snakes will bite when bothered by people. You will not get bitten if you stay several feet away from a snake. The best way to avoid a problem with venomous snakes is to not get bitten. Since most snakebites happen when people carelessly handle a snake, don't try to pick up *any* snake you find outside.

Read and Find Out

- *Animal Tracks and Traces* by Kathleen Kudlinski, Franklin Watts, 1991.
- *Crinkleroot's Book of Animal Tracking* by Jim Arnosky, Macmillan, 1989.
- *A Guide to the Behavior of Common Birds* by Donald W. Stokes, Little, Brown, 1979.
- *The Kids' Wildlife Book* by Warner Shedd, Williamson Publishing Co., 1994.
- *Nature Detective: How to Solve Outdoor Mysteries* by Eileen M. Docekal, Sterling Publishing Co., 1989.
- *Nature Journaling* by Clare Walker Leslie and Charles E.Roth, Storey Books, 1998.
- *Put on Some Antlers and Walk Like a Moose (How Scientists Find, Follow and Study Wild Animals)* by April Pulley Sayre, Twenty-First Century Books, 1997.

In *Wildlife in North Carolina*:

- "Hospital for Hawks" by Ginny Engelhard and Abe Schwartz, May 1979.
- "The Hands-Off Season" by Jay Davies, May 1985.
- "Man's Best Friend?" by Rick Estes, March 1982.



If lots of turtles cross your road at a certain time of year, put up a sign to warn motorists to slow down.

I found a hawk in a ditch on the side of the road. It's struggling, but can't fly. What should I do?

Don't touch an injured animal. You might hurt the animal further or the frightened animal could struggle and hurt you. Call your local nature center, animal shelter or veterinarian to find out the name of an animal rehabilitator who can care for the hawk. Animal rehabilitators are specially trained to take care of injured wildlife, and have a permit to do so.

What Does It Mean?

nestling: a bird that is too young to leave the nest

fledgling: a young bird that has recently grown flight feathers and cannot yet fly well

glands: body cells that specifically secrete a substance

salmonella: a type of bacteria that causes food poisoning and other infectious diseases

venomous: an animal that can secrete a poison, usually with a bite

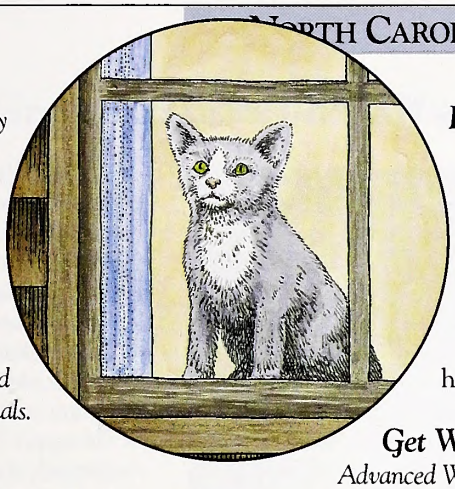
Get Outside

All you need to be a nature watcher are your eyes and ears. If you add some curiosity and patience, you are sure to find lots of excitement, even in your own backyard.

What can you find under a rotting log or beneath a stone? Who can you hear singing in trees and leaping through branches?

When you find an animal, watch it carefully. Is it by itself or following others? Searching for food? Carrying material for a nest? Write down what you observe in a notepad and make a sketch of the animal or describe it. Stay far enough away so that you do not disturb the animal.

Visit the Museum: Nature Fun Theater, Fridays at 10:30 and 11:30 a.m. Sing songs, solve riddles and have lots of fun at the museum's live theater programs. All programs are free. North Carolina Museum of Natural Sciences. For more information, call (919) 733-7450.



You can help baby birds and other small animals by keeping your cat inside your house.

Hunting cats stalk nestlings and fledglings, as well as lizards and small mammals.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

Wild Words...A Journal-Making Activity: teaches students to observe and describe their surroundings, especially out-of-doors.

Changing Attitudes: teaches students to recognize factors which influence changing attitudes about wildlife and the environment.

Keeping Score: teaches students the cause-and-effect relationships that help and hinder wildlife in their community.

Special Event

June 13-18 - *Fur, Fish'n Game Rendevouz Camp*: outdoor education camp for youths ages 12-15 at Camp New Hope near Ellerbe. First 85 applicants only. Registration must be postmarked by April 1 - $235. After April 1 - $250. Contact your local county Cooperative Extension Service for registration forms or call (919) 515-3244.

Get WILD

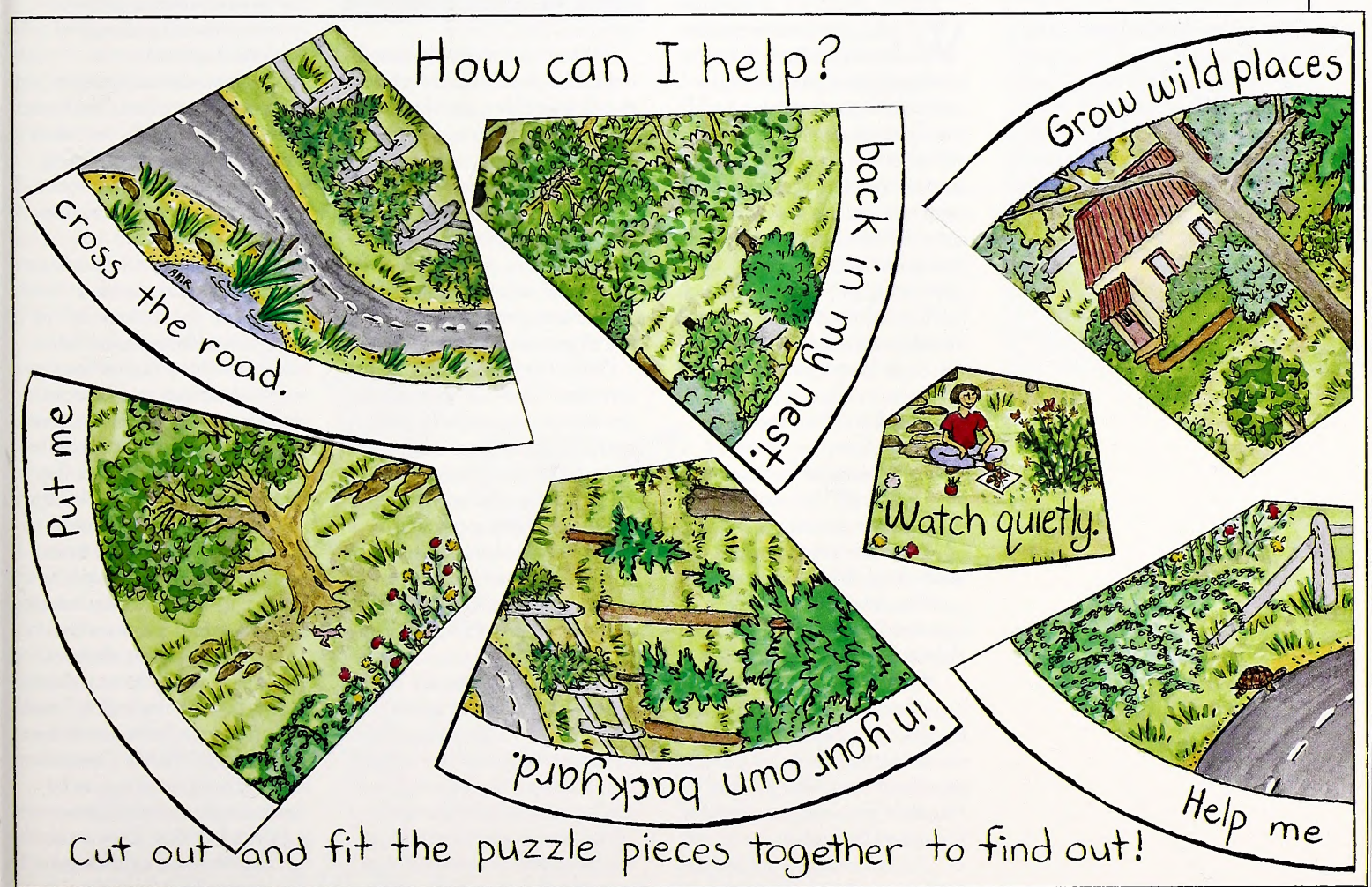
Advanced WILD Workshops:

April 17-18 - *Migratory Songbirds*, Cool Springs Environmental Education Center near New Bern. Call Mike Campbell, (252) 514-6663.

April 24-25 - *Migratory Songbirds*, Howell Woods Environmental Education Center, Smithfield. Call Katrina McDougald, (919) 751-2040.

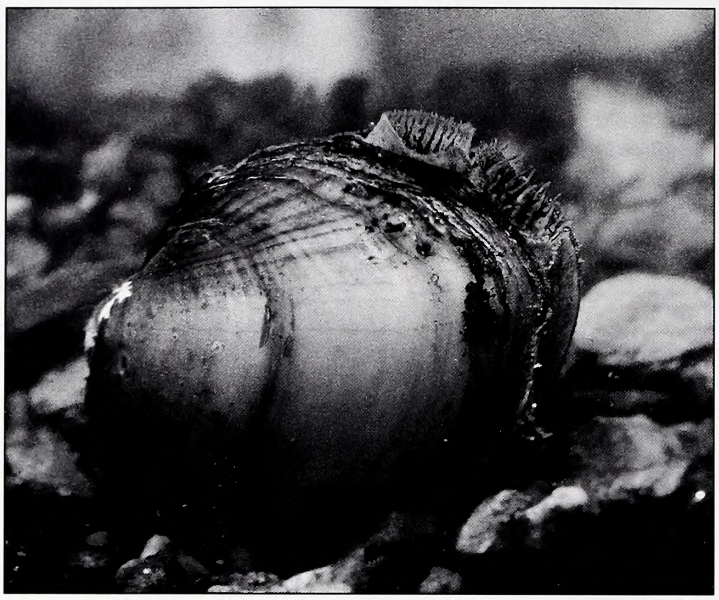
May 22-23 - *Aquatic Ecosystems*, Fayetteville. Call Katrina McDougald, (919) 751-2040.

June 21-23 - *Mountain Stream Ecology*, Pisgah Center for Wildlife Education, Brevard. Call program coodinator, (828) 877-4423.



Editing and design by Consie Powell. Art puzzle by Anne Marshall Runyon.

Timber Products Giant Champions Wide Riparian Buffers



JOHN ALDERMAN

The yellow lampmussel *(Lampsilis cariosa) is one of 10 rare mussel species found in Fishing Creek and Swift Creek subbasins of the upper Tar River. To protect these and other endangered aquatic species, Champion International Corp. has agreed to maintain 200-foot wide riparian buffers on 32 miles of streams.*

Edited by Chris Powell

While many landowners in the Neuse River Basin have been protesting a temporary rule requiring them to leave pollution-reducing buffers of 50 feet on either side of streams, one large corporate landowner in the state is taking a different tack. Champion International Corp., the forest products giant, is voluntarily leaving 200-foot buffers along 32 miles of streams in the Upper Tar River Basin, and the corporation is calling for other large landowners in the region to do the same.

The agreement by Champion amounts to 800 acres of buffers that will significantly affect one of North Carolina's remaining areas of aquatic biodiversity, said Sam Hamilton, Southeast regional director of the U.S. Fish and Wildlife Service.

"Champion is to be highly commended for their corporate leadership and initiative toward the conservation of this globally significant river system," said Hamilton, at a recent ceremony honoring Champion.

Champion signed the Memorandum of Understanding in February 1998. The agreement was also signed by the N.C. Wildlife Resources Commission, the U.S. Fish and Wildlife Service, the N.C. Department of Environment and Natural Resources, The Nature Conservancy and North Carolina Partners in Flight.

According to the specific terms of the agreement, Champion will honor a no-harvest zone from the river edge either to 50 feet or to the top of the first levee, whichever is greater. Within the remaining 150 feet of the buffer, Champion may cut trees using single-tree or small-group-selection harvest methods. Champion further agreed to avoid converting the current hardwood or mixed forests to pine forests.

"We are leaving 200-foot buffers because we were advised that if we really wanted to make a difference and keep sediment out, that was the necessary width," said Danny Morgan, of Champion. "We have a genuine concern about the mussel populations in the stream as well as the endangered fish and amphibian species that we'd like to protect."

Wide forested buffers are considered the best way to limit the amount of nonpoint pollution entering streams and rivers. They can remove substantial amounts of excess nutrients and sediments flowing from farm fields and feed lots before the contaminants enter streams. Buffers are especially important in the upper Tar River because of the region's diverse, rare freshwater mussel species. Freshwater mussels are critical to the health of rivers, filtering pollutants and sediments out of the water. Yet, most of North Carolina's rivers are nearly empty of the once common mollusks, and nonpoint-source pollution is considered one of the major reasons for their decline.

Although the problem is widespread throughout the nation, it is especially acute in the Southeast. Ninety-four percent of the nation's freshwater mussel species inhabit the region, prompting conservationists to describe it as the world's "rain forest" of freshwater mollusk diversity.

The upper Tar River system —especially the Fishing Creek and Swift Creek subbasins—is considered a biological treasure. The Upper Tar contains 10 rare species of freshwater mussels, including two federally endangered species and three that are potential candidates. Swift Creek subbasin in particular has been identified as one of the most significant creek ecosystems remaining along the Atlantic Seaboard.

Champion's conservation action is also significant for many other wildlife species. Forested buffers provide critical nesting habitat for many interior forest birds as well as travel corridors for larger animals.

Champion has taken other noteworthy conservation actions throughout the nation, such as the Special Places in the Forest initiative. This program has provided protection to 46 special sites located on 5.4 million acres of forestland, owned nationally by Champion. The Upper Tar River Basin is one of those sites. And to prove its commitment to sustainable forestry, Champion recently proposed an initiative to open its United States forestlands to a third-party review.

"The great thing about Champion's agreement is that it's a model for the region," said John Alderman, nongame biologist with the Wildlife Commission. "Champion wants to be the leader in terms of conserving lands like this. They are to be congratulated for their generous conservation gift."

—Lawrence S. Earley

Quail, Grouse and Woodcock Populations Suffer Decline

A survey of the 1997-98 upland game bird hunting seasons indicates that quail, grouse and woodcock populations are declining.

Terry Sharpe, small game project leader for the N.C. Wildlife Resources Commission, said the game bird declines documented by the 1997-98 Avid Quail Hunter Survey were likely a result of widespread land-use practices.

"It is little subtle changes that are occurring," Sharpe said. "For instance, woodcock are being affected by the aging woodlands in the northeast part of the country. Woodcock are migratory and need new-growth forests."

"Quail populations are down due to the predominance of closed-canopy forests, less burning, summer mowing and the use of herbicides to control weeds," he added.

Quail populations are believed to be at an all-time low. Data from 2,142 hunts indicated success rates of 1.65 coveys per trip. Hunters had reported 1.72 coveys per trip during the 1996-97 season.

The lowest success rates on the Coastal Plain continued to occur in the southern counties. Of 203 outings, hunters reported 1.31 coveys per trip (a 5-percent increase from 1996-97).

Hunters in the northern Coastal Plain counties continued to record the highest success rates in the state. Hunters in the central Coastal Plain counties reported 2.25 coveys per trip out of 646 trips. Hunters from northern Coastal Plain counties reported 1.74 coveys per trip out of 404 trips.

Coveys per trip reported from the Piedmont region also declined. Out of 219 southern Piedmont hunts, covey flushes decreased from 1.57 in 1996-97 to 1.2 in 1997-98 (a 24-percent decrease). From 181 Central Piedmont hunts, averages decreased 15 percent to .99 covey per trip.

MELISSA McGAW

***Nesting quail are** becoming less common as widespread land-use practices continue to limit habitat.*

The average from 364 northern Piedmont hunts increased slightly from 1.29 coveys per trip in 1996-97 to 1.43 coveys per trip in 1997-98 (10 percent).

Out of 46 hunts, Southern Mountain hunters reported 1.31 coveys per trip. Northern Mountain hunters averaged 1.07 coveys per trip on 76 hunts. Statewide, success rates were highest during November (1.74 coveys per trip) and February (1.77 coveys per trip).

Avid Grouse Hunter Survey

During the 1997-98 season, 87 grouse hunters provided data from 1,451 hunts. Statewide, flushes per trip decreased by 10 percent and birds harvested per trip did not change between the 1996-97 and 1997-98 seasons.

Hunters reported flushing an average of 4.87 birds per trip and harvesting .695 birds per trip. Average flush rates for 1997-98 were 4 percent below the long-term average, while harvest-per-trip ratios were 4 percent below average.

Hunters from the Southern Mountain region reported bagging an average of .75 bird per trip during 1,057 hunts, which matches the statistics from the 1996-97 season. In the Northern Mountain region, .54 bird per trip was averaged during 394 hunts, down 6 percent from the 1996-97 season.

Flush rates and harvest rates peaked in February, when hunters reported flushing 5.35 birds per trip and harvesting .8 bird per trip during 352 hunts. Poorest success rates were in October, when hunters reported flushing 2.99 birds per trip and bagging .3 bird per trip from 129 hunts.

Data was also received from hunters reporting on 664 public game land hunts and 749 private hunts. Flushes per trip averaged 4.11 on game lands and 5.5 on private land (34 percent higher on private land). Hunts on game lands averaged harvests of .57 bird per trip, while private hunts averaged .78 bird per trip.

Woodcock Update

A recent review of woodcock survey data indicates their numbers are still declining. The number of woodcocks in the Eastern Region remained consistent with 1997 levels, and 10-year trends were negative for the Eastern region, with a 4.3-percent decline per year. The 1997 recruitment index of 1.4 immature woodcocks per adult female remains 18 percent below the long-term average. Recruitment has been below average since 1992, and the cause of this decline remains unknown.

—courtesy of the Migratory Shore and Upland Bird Committee

Field Notes

Wild Turkey (bearded birds only)—April 10-May 8

Hatchery-Supported Trout Waters—Opens April 3

Wild Trout Waters—Year-Round

Waterfowl

Snow and Blue Geese—Through March 10

Information on bag limits and other regulations may be found in the *1998-99 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest*. For a copy, check with license agents or contact the N.C. Wildlife Resources Commission at 1-800-675-0263.

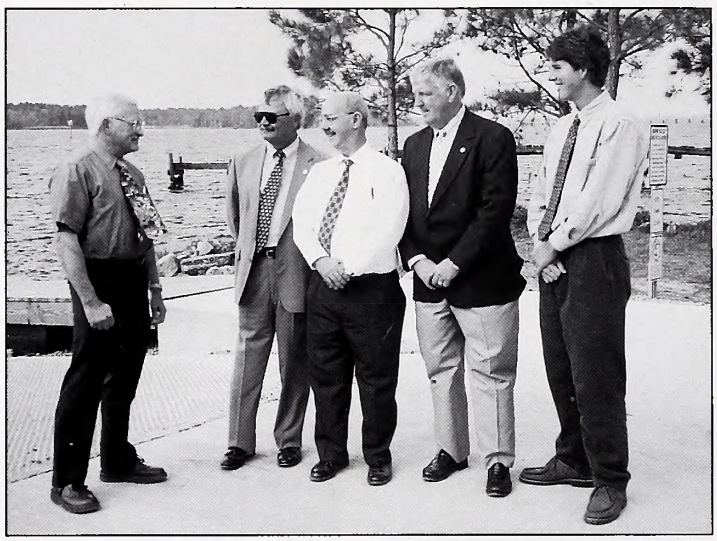
Outdoor Tip

Simple Point File Hook Sharpener— Nowadays, most high-quality fish hooks come pre-sharpened and are keen enough to do the job. But not all of them, and hooks quickly get dull with use. There are lots of fancy hook hones on the market, and some are even motor driven. However, most are bulky and expensive. You can get good results using nothing more than an automobile spark plug point file. They're inexpensive, work better than most stone hook hones, and are small enough to carry in your vest or tackle box tray. You'll find them at most auto parts and hardware stores.

—Jim Dean, Raleigh

Editor's note: *Do you have a tip or suggestion you would like to share with our readers? If so, please write Chris Powell at the N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27604; Fax: (919) 715-2381; E-mail: (powell.chris@coned.wildlife.state.nc.us)*

Belhaven Gets New Access Area for Anglers and Boaters



BODIE McDOWELL

The North Carolina Wildlife Resources Commission *recently opened a new boating access area in Belhaven. Taking part in the ceremony (from left) are: Charles O. Boyette, mayor of Belhaven; Charles Fullwood, executive director of the N.C. Wildlife Resources Commission; Tom Miller, administrator of the Pungo District Hospital (which provided land in a trade); Wildlife Commissioner Arthur J. Williams III, of Washington; and Gordon Myers, chief of the Wildlife Commission's Division of Engineering Services.*

Anglers and boaters wanting access to the Pungo River and the Intracoastal Waterway are having an easier time getting their boats in the water, thanks to the recent opening of the Belhaven Access Area on West Water Street. The access area has a dual ramp, 28 regular parking places for tow vehicles and boats, two handicapped parking spaces and overflow parking across Water Street.

The project was funded by the N.C. Wildlife Resources Commission and constructed by the Commission's Division of Engineering Services.

During the last two years, the Division of Engineering Services has constructed a total of five new boating access areas. In addition, renovations and improvements were made to 12 existing boating access areas.

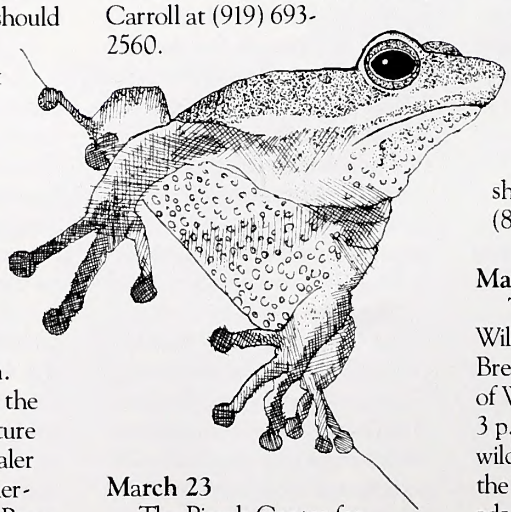
—Bodie McDowell

North Carolina Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

March 20

The North Carolina Bowhunters Association will hold its 13th annual Bowhunters Convention and Banquet at the Ramada Inn in Burlington. The convention is open to the general public and will feature bow-hunting seminars, dealer displays of bow-hunting merchandise as well as official Pope and Young and Boone and Crockett measurers. For more information, contact NCBA President Connie Tysinger at (336) 272-3000 or Ramon Bell, NCBA records chairman, at (336) 643-4455. For advanced Banquet reservations, call Kathy Carroll at (919) 693-2560.



March 23

The Pisgah Center for Wildlife Education, located near Brevard, will host a Nature Nuts – Owl program from 9:30 a.m. to 11:30 a.m. Nature Nuts—Owls is a program series for young children ages 3 to 6 and their parents. Each program will focus on a different wildlife theme and will include stories and activities that engage children with the natural world. Each program is limited to 15 children. To register for a course or workshop, please call the center at (828) 877-4423.

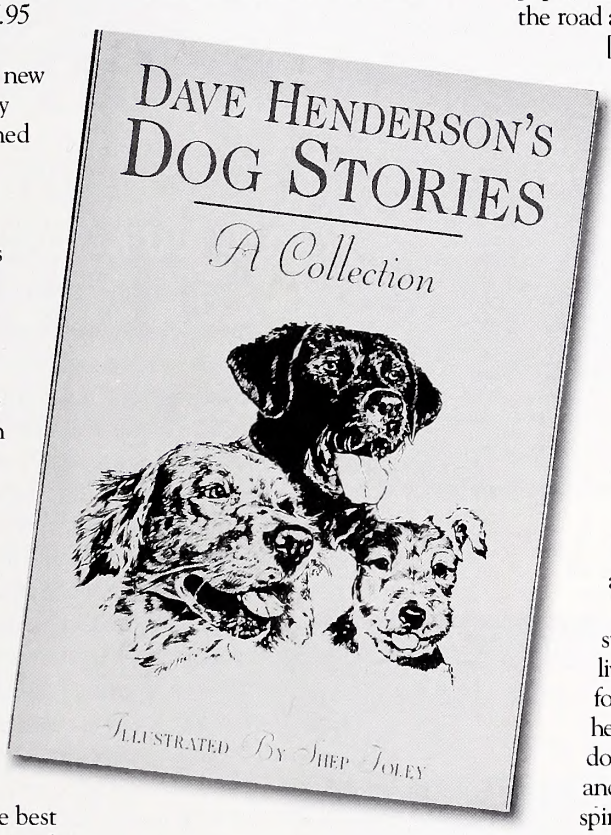
March 27

The Pisgah Center for Wildlife Education, located near Brevard, will feature a Wonders of Wildlife program from 2 to 3 p.m. Featuring rehabilitated wildlife, this program explores the physical and behavioral adaptations that help animals survive. To register for a course or workshop, please call the center at (828) 877-4423.

New Book: *Dave Henderson's Dog Stories, A Collection*

Dave Henderson's Dog Stories, A Collection, *illustrated by Shepard H. Foley (Winchester Press, 1998; $17.95 hardback).*

David Henderson's new book will be enjoyed by anyone who's ever owned a dog, loved a dog or chased a dog—especially a hunting dog. He has written his book, he says, to give "some insight into the mystery of man's love affair with his dog." But there's more to it than that. Though the author acknowledges that his tales are mostly fiction, they're stamped with the indelible flavor of North Carolina field, forest and water.



Many of the stories involve bird dogs, bird hunting and, not surprisingly, are tinged with humor. One of the best is about two bird hunters who strike up an uneasy friendship while hunting adjacent fields. When one of them buys a new bird dog, the other immediately recognizes it as his own, lost some months before. But there's no tag or collar. To defuse the tense standoff, the claimant performs a little "experiment" to prove his ownership. "'Sally, go fetch me my paper,'" he says. "Trotting across the road and rearing up on his [mailbox], that's exactly what she did."

For those whose canine preferences fall to water dogs, there are tales of Chesapeakes and Black Labs set in legendary Currituck. There are stories about boatmen and family feuds that run for two or three generations. And what's a book about dogs without a ghost story or two ("Ghost of Rosetree Plantation" and "Lumbee Ghost")?

All of Henderson's stories bespeak a lifetime lived in the presence of four-footed friends. As he writes, "This is the dog. This is our friend and companion who inspires great literature, great art and even short stories that pop into this writer's head in the dead of night."

—*Lawrence S. Earley*

Reader Has "Beef" With Magazine Illustration

Dear Wildlife:

I have been a lifetime subscriber to *Wildlife in North Carolina* for many years now and have enjoyed reading many articles.

However, I am disturbed by what I saw in the November issue. The section entitled "North Carolina Wild Notebook" on page 31 contains a diagram, "River Dance of the Mussels." Pictured on the river, earmarked "pollution," are two Holstein cows, implying that they are the source of pollution. Being a North Carolina dairy farmer, I am well aware that the newly instated legislative laws allow zero runoff for all farmers.

I feel strongly that you owe North Carolina farmers an apology. A more truthful source of pollution would be industries or municipalities. Since farmers live off the land, they certainly do not want to pollute it!

In conclusion, I would appreciate a proper apology. I would not want your readers to be misled by such fallacies. Farmers are lovers of wildlife and do much to protect our environment.

—*David M. Coltrane, Pleasant Garden*

Editors response: Thank you for your recent letter regarding the illustration in our "N.C. Wild Notebook." I can't help but agree with your statement that: "Farmers are lovers of wildlife and do much to protect our environment." By picturing the cows in the stream, our artist certainly didn't mean to suggest that farmers were the sole source of sediment and nutrient pollution. Development activities were also shown in the illustration, which contribute their share, as do cities and industries, which you rightly pointed out.

On Patrol

Editor's note: *While most North Carolina hunters are law-abiding, a few are not. Listed below are a few reports of wildlife violations that illustrate some of the humorous, and at times bizarre, situations our wildlife enforcement officers encounter while on patrol.*

•A wildlife officer in Hyde County recently checked two subjects on an impoundment, who already had their limit of wood ducks. The men were using a retriever, and as the officer approached, one of them held the dog by the collar and told the officer the dog would bite if he let him go. The dog was straining at the collar, but not in the officer's direction. The officer asked to see their license, and the hunter released his hold on the dog while he tried to dig out his wallet. The officer looked at the dog and said "fetch." The dog bounded off only to return with an over-the-limit third wood duck.

Nothing beats a good retriever.

•A big problem with using deer decoys has been the damage they are taking. The heads were blown completely off in several cases. In one Greene County case when the decoy's head came off, the violators still thought they had shot a real deer. When asked why they didn't realize it was a decoy when the head blew off, the suspects responded that they thought that was supposed to happen when the bullet hit a deer.

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through December 1998

Principal Balance
$27,025,243.39

Interest Earned
$27,208,026.38

Total Receipts
$54,233,269.77

Interest Used
$15,250,446.04

Fund Balance
$38,982,823.73

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.

Spring Improvements

by Rodney Foushee

March marks the official start of spring, making it a perfect time to get started on some wildlife habitat improvement projects for your land.

Rounding Up Fescue: Now is the time to make the decision to plant warm-season grasses on your property. Not only do native grasses including bluestem and switchgrass produce superior summer grazing forage for cattle, they also provide excellent habitat for quail and songbirds. But first, you must kill off existing cool-season grass such as fescue. That means applying Roundup or another suitable herbicide in April and then planting warm-season grasses the following month. Luckily, the Wildlife Commission can take all of the guesswork out of this project by providing you with detailed technical information including herbicide application rates, planting strategies and seed sources. You may also qualify for financial assistance through several cost-share programs. Contact your district wildlife biologist or call (919) 733-7291 for more information on converting to warm-season grasses.

Flooding Farm Ponds: There is still time to take advantage of early spring rains to fill your favorite honey hole before summer. Go ahead and plug your drains early this month and you'll be rewarded with plenty of water (and fish) in May.

Planting Trees: Now is an excellent time to plant fruiting trees and shrubs to give the plants a chance to establish before summer's heat arrives. Some good choices for wildlife include crabapples, plums, dogwoods, hazelnuts and chinquapins. Contact your local nursery or Extension Service agent for proper planting procedures.

Building Brush Piles: March is a good month to get in the woods and cut firewood for next winter. While you're at it, take a little extra time to pile the tops of trees and branches together to form brush piles for rabbits and other small game. These piles will provide cover for wildlife from avian predators such as hawks and owls as well as ground-dwellers including foxes and cats. The bigger the brush piles the better, but don't pack them too tightly. Wildlife will appreciate your extra effort.

N.C. WILD STORE

And now *for our* feature presentations.

Coming soon to a VCR near you. The N.C. WILD Store proudly presents four unique nature videos, featuring cameo appearances by an all-star cast of wildlife. Hurry and find your seats, as the outdoors comes indoors with four interesting and educational adventures the whole family can enjoy. Pop the corn, pour the sodas and dim the lights—the shows are about to begin. Sh-h-h...

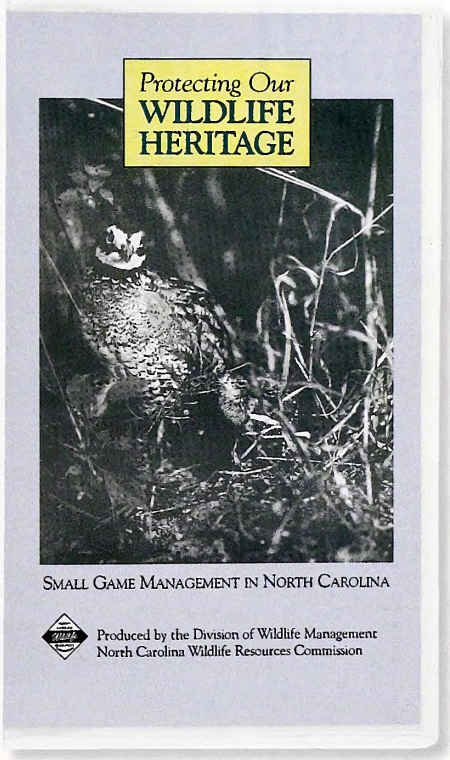
ALL THINGS ARE CONNECTED
Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.
ITEM CODE **W1**

PROTECTING OUR WILDLIFE HERITAGE
25-minute video offers useful tips for landowners on managing small game. $20.
ITEM CODE **N8**

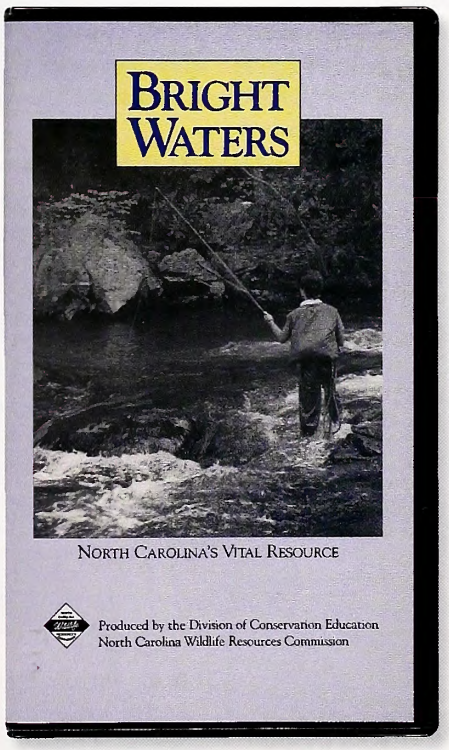
BRIGHT WATERS
30-minute video on fishing and fisheries management in North Carolina's freshwater creeks, rivers and ponds. $20.
ITEM CODE **N7**

WILDLIFE BABIES
Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others. $20.
ITEM CODE **N9**

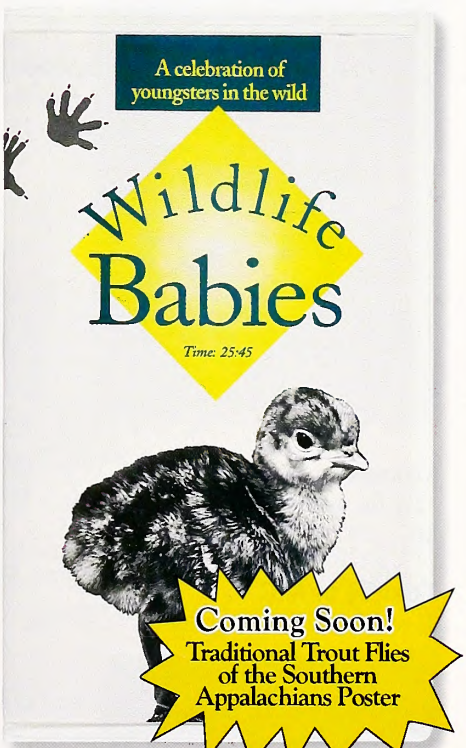
environmental ethics



habitat for small game



freshwater fish



youngsters at play

More terrific items

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

WATERFOWL DECOYS OF N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.
ITEM CODE P12

PISGAH CENTER FOR WILDLIFE EDUCATION T-SHIRT

"Mountain streams, where water and life begin" is printed on the back of a 100% cotton, natural color T-shirt with colorful Pisgah Center logo. Located near Pisgah Forest in Transylvania County, the Pisgah Center should be included in your next visit to the N.C. mountains. $14.50.
ITEM CODES:
A8MED (medium)
A8LRG (large)
A8XLG (extra large)
A8XXL (extra extra large)

WILDLIFE IN N.C. CAPS

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE A3

Blaze orange and camouflage caps are embroidered with magazine logo and buck deer silhouette. $16.50 each.

Blaze orange with brown waxcloth bill. ITEM CODE A7

Advantage® Camouflage with tan suede bill. ITEM CODE A6

FROGS OF N.C. (THE HYLIDS)

Presents all 15 of the state's tree frogs, cricket frogs and chorus frogs. 22" x 34". $6. ITEM CODE P11

N.C. WILD CAP (not shown)

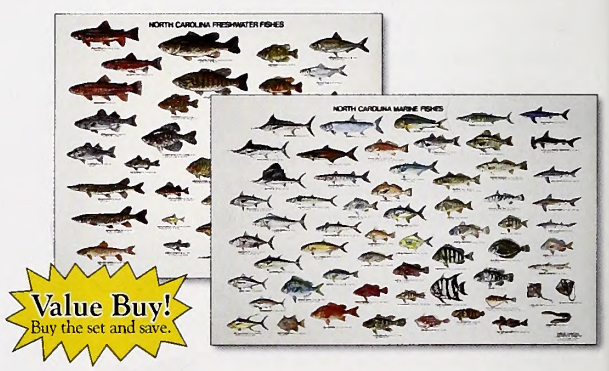
N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50.
ITEM CODE A1

LIZARDS OF N.C.

12 of the state's lizard species. 22" x 34". $6. ITEM CODE P3

TURTLES OF N.C.

21 of the state's turtle species. 22" x 34". $6.
ITEM CODE P4



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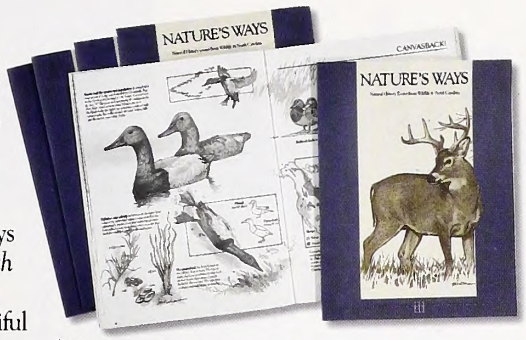

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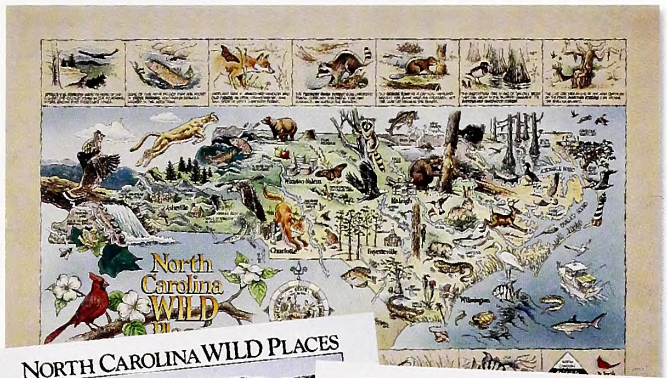

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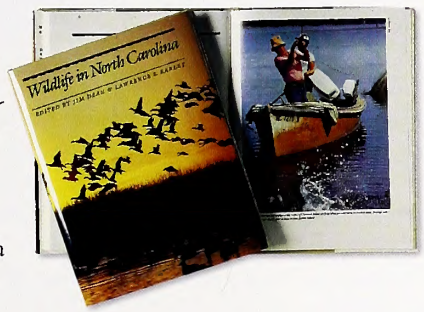

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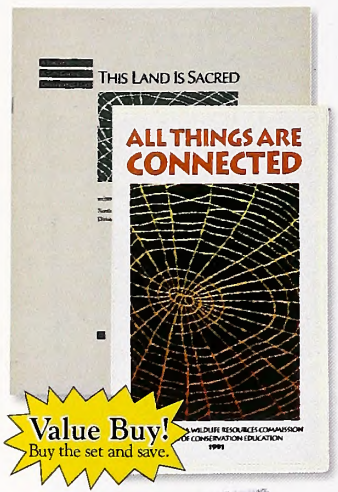

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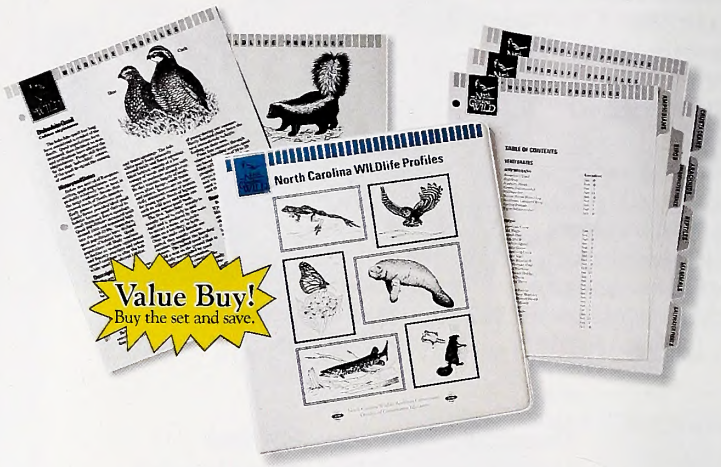

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WILDLIFE COMMISSION

SPOTLIGHT

"Colonial" Doesn't Mean the Birds Are *Old*.

Many of the birds we think of as "waterbirds" nest in groups called colonies, so we call them "colonial waterbirds." Some of these groups number in the thousands. North Carolina has 25 species of colony-nesting waterbirds. They include seven different species of terns, three gulls, the black skimmer, three egrets, four herons, two night herons, two ibis, pelicans, cormorants and anhingas. In addition, a rare sooty tern can be found nesting in the state, and several other colonial nesters pass through the state during migration, or use our coast for wintering or post-breeding activities. Wood storks are expanding their range from the south, and are now nesting within about 15 miles of our southern border. In fact, a post-breeding flock of wood storks forages and roosts near Sunset Beach.

MELISSA McGAW

Brown pelican

MELISSA McGAW

Royal tern and chick

The Wildlife Resources Commission works with other agencies along our coast to provide colonial waterbirds with undisturbed areas to build nests and raise their young.

The Nongame and Endangered Wildlife Section of the Wildlife Resources Commission has several projects focused on conservation of these birds, including:

•A census of all colony-nesting waterbirds is conducted about every other year to keep tabs on population fluctuations.

• The Wildlife Commission is filming a video about colony-nesting birds to be shown on state ferries. It will highlight birding opportunities from the ferries, and discuss the need for the birds to have undisturbed nesting sites.

• Plans are being made to construct an island near Hatteras Inlet where birds can nest undisturbed.

• Coordination with the Army Corps of Engineers directs dredged material from our coastal water channels to islands that improve nesting habitat for several species of colonial waterbirds.

KEN TAYLOR

Biologists post nesting grounds

KEN TAYLOR

Glossy ibis eggs

RETURN THE GIFT

The Nongame and Endangered Wildlife Program is dedicated to conserving native wildlife of North Carolina. Please lend your support to this effort through a tax-deductible contribution on your North Carolina income tax form or send your contribution to Nongame and Endangered Wildlife, N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27604-1188.

Hauling the Net

Muscles tense and backs strain to haul in a net bulging with a fall run of spot, an annual tradition for commercial fishermen at Cape Lookout. Management efforts are underway to ensure scenes like this do not become a thing of the past. Story begins on page 4.

Periodicals postage paid at
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LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
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45
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WILDLIFE IN NORTH CAROLINA

APRIL 1999 $1.50

N.C. DOCUMENTS
MAR 31

The Marshmallow Purists

by Jim Dean ©1999

ILLUSTRATED BY JACKIE PITTMAN ©1999

"Sometimes the best way to crush a stereotype is to play to your adversary's worst fears."

Maybe it's the fact that we are away from home and the joyous anticipation of adventure runs overly ripe. Or maybe it's because we can't resist the urge to redefine our identity in the presence of those who don't know us. Or perhaps it's just that, regardless of age, we are all still kids full of barely contained devilment. Whatever it is, I have observed that the practical joke is never more tempting than when we gather with new companions to share our common obsessions while fishing or hunting in distant places. Even the most even-tempered among us is very likely to become predator, or prey.

My friend Matt Hodgson, for example, pursues his ruling passion for fly fishing seriously, but like many who have been at it a long time, he sometimes grows weary of the near-religious pedantry that he encounters among some anglers who have been newly baptized in the oft-contrived rituals of this sport. "It gets tedious," he observed, and he told me this story.

On a recent trip to fish in Montana, he and his companions found themselves in company one morning with a guide who seemed far too inclined to preach the gospel. "Now, I don't know how you fellows fish back home," he sniffed, "but here we fish only with flies and we release all trout. I hope that you will fish with dry flies, too, if you have any."

Matt hardly anticipated any such sermon. Not only is this retired director of The University of North Carolina Press unlikely to be taken for a rube, his experience as a fly fisherman and fly tier far exceeded the guide's.

Sometimes the best way to crush a stereotype is to play to your adversary's worst fears.

"Well, to tell the truth," Matt replied, "What I had in mind was a technique we prefer back home in North Carolina. Why don't you fellows go on ahead, and I'll run back into town and get about 200 yards of stout cord and some 3/0 hooks. This looks like a really good place to set a trotline. You don't right offhand know where I could get a mess of chicken necks for bait do you?"

For a moment, the guide looked as though he had caught a bullet with his teeth, but when the laughter died down and he realized that Matt had no intention of stringing chicken necks across the Yellowstone River, he relaxed and joined his peers for an enjoyable day fly fishing the river.

Those of us bred and born in the brierpatch of Southern culture are frequently called upon to diffuse an unfortunate (or fortunate) stereotype when we travel to distant places where our mother tongue is automatically linked to toothless ignorance and inbreeding. But sometimes it's just fun to keep those suspicions alive, too.

In the early 1970s, some friends and I journeyed to Pennsylvania to fish the storied limestone streams of Pennsylvania where Vincent Marinaro, Charley Fox, Ed Koch and others had spawned a new and highly sophisticated technique for catching wild trout on flies carefully fashioned to imitate terrestrial insects. We had spent the winter tying flies, reading the literature and preparing ourselves for this crusade to Mecca.

We drove all night and rendezvoused with our Keystone State guides on the stream shortly after dawn. They seemed a bit reserved, but they looked at our tackle and apparently decided that we at least looked like fly fisherpersons. My friends, however, were not about to let such an educational opportunity pass. As we tromped down to the water, we swapped those precious bits of information that are thinly disguised to reveal our knowledge and establish our credentials. Fly boxes were shared and patterns compared. Just when it looked as though we might be accepted, one of the Pennsylvania anglers asked to see the patterns I'd been tying for this occasion.

Proudly, I produced my fly box and flipped open the lid. Each compartment was filled with tiny marshmallows, sorted by color—white, pink, yellow, green. I was stunned. The Pennsylvanians looked as though someone had slapped them with a wet carp.

"But...but," I stammered.

"Yep," said one of my North Carolina companions. "We should have warned you, I suppose. Dean, here, can match any hatch with a marshmallow. Fishes them dry, too."

The worst of it was that my Tar Heel buddies had emptied several hundred of my flies into a paper sack—took hours to get them sorted out. But everyone—well, almost everyone—had a good laugh and another stereotype had bitten the dust. We had a grand time fishing together that week.

And one of us had colorful snacks to eat on the stream, too.

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Wildlife in North Carolina

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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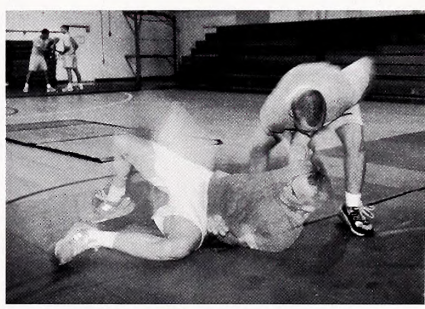
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24 **Ten Turkey Turnoffs**
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Gobblers survive your best efforts each spring because they can count on you making mistakes. Eliminate some of these classic goofs and you just might get lucky.

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Cover *A pair of hooded warblers works hard to raise its nestlings. Photograph by Maslowski Photography.* ©1999

Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 1-800-662-7726. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Orchids with Attitudes

written by David S. Lee ©1999
illustrated by David Williams

For many people, the thought of orchids either brings to mind exotic, showy flowers splashing colors across a tropical rain forest, or a memory of a long-ago prom date, the one with the braces. Orchids are the richest family of flowering plants with at least 25,000 species having been described. Though most orchids do indeed grow in the tropics, many species are found in temperate locations. In North Carolina, for example, more than 50 native species can be found. The showiest, and the best-known natives, are the lady's slippers, sometimes called moccasin flowers. Both names refer to the shoe-shaped petal sac.

Lady's slippers can be found growing from the subtropics to the arctic regions of the Northern Hemisphere. The two common species that live in the state are the pink and the yellow; a third type—the showy lady's slipper—is confined to a few sites in the mountains.

Many tropical species grow as epiphytes on the trunks and branches of trees, drawing their nutrition from air and rain. Lady's slippers, however, are terrestrial orchids, sprouting annually from elongated fibrous rhizomes. Their flowers appear in the spring soon after the plant's leaves emerge from the forest floor. Insects are enticed by the flower's attractive colors and faint fragrance.

Most of us have trouble thinking of flowers as deceitful, but to its potential pollinators the flowers of lady's slippers are just that. The flower is comprised, in part, by a sack-like, slipper-shaped, pouch. The pouch has three openings arranged and designed to control the flow of insect traffic. The central opening is the entrance and two exit routes occur on the back side of the flower.

Mining bees (*Andrena*) are one of the principal pollinators of the lady's slipper. The lady's slipper does not secrete true nectar. Lured by droplets of fluid that adhere to hairs at the base of the lip, the bees enter the sac and are temporarily trapped by the slipper's lip. The interior margins of the flower's enlarged central petal are curved inward and covered with miniature hairs that point backward from the entrance. This combination allows easy access while discouraging an exit through the main entrance. The margins of the petals in the back of the flower turn outward and so do the minute hairs.

To get out of the lady's slipper once it has been lured in, the insect is encouraged to the rear of the flower by a translucent patch that lights the way to the exits. To reach either exit the insect must force its way by squeezing below the stigma. Its route is further directed by a stiff triangular growth, a sterile modified stamen, positioned above the female part of the flower. Any pollen brought in will be scraped off on the female part of the flower as the bee exits.

The lady's slipper's pollen mass is held in place by rigid arms positioned directly in the way of either escape path. The pollen grains are held on a sticky disk that adheres to the insect as it passes so that when the bee pulls away, the pollen showers down. The pollen grains stick like plaster to the hairy back of the escaping insect which, with luck, will ferry them to the next lady's slipper where cross-fertilization will take place. Self-pollination is not possible.

Though the pollination process is not random, it does require some luck. Indeed, because of the exactness of the pollination process, as few as 10 percent of the flowers in many places produce seed capsules. Only insects of appropriate size can efficiently pollinate lady's slippers. Often both small and oversized insects become trapped in the pouch and die, while powerful ones such as bumble bees sometimes chew or claw their way to freedom by going through the flower's membrane. The flowers of lady's slippers usually last for several weeks, thus increasing their chance of being pollinated, but often the flower withers and shrinks without ever being visited by a pollen-bearing insect of the right size.

Yet one seed pod, if it successfully matures, produces about 10,000 seeds, providing enough to sow the woodlands with another generation of lady's slippers.

Other Reading

- "The Sex Life of Plants," Lawrence S. Earley, *Wildlife in North Carolina* (April 1987).
- Friedrich G. Barth, *Insects and Flowers: The Biology of a Partnership* (Princeton Science Library, 1991).
- Bastiaan Meeuse and Sean Morris, *The Sex Life of Flowers* (Facts on File, 1984).
- Michael Proctor, *The Natural History of Pollination* (Timber Press, 1996).

Surfing the Web

- "Orchids of the Southern Appalachians" has good color photos and descriptions of the medicinal and other properties of our native orchids. *Address:* http://ncnatural.com/wildflwr/orchids.html

With more than *25,000 species, orchids are the largest family of flowering plants. The yellow lady's slipper is one of the most common orchid species in North Carolina and also occurs across much of North America as well as in Europe and Asia.*

All orchids have *three sepals (1) and three petals (2), although these parts are fused and reduced in the lady's slippers. In most orchids the lowest petal, the lip (3) is larger and more showy. Projecting from the flower's center is a fleshy fusion of the male and female reproductive organs (4).*

Continental range of yellow lady's slipper

In this cross section of *a lady's slipper flower, the arrows show the route of pollinating insects. A translucent patch guides the insect to an exit.*

A Natural Alternative

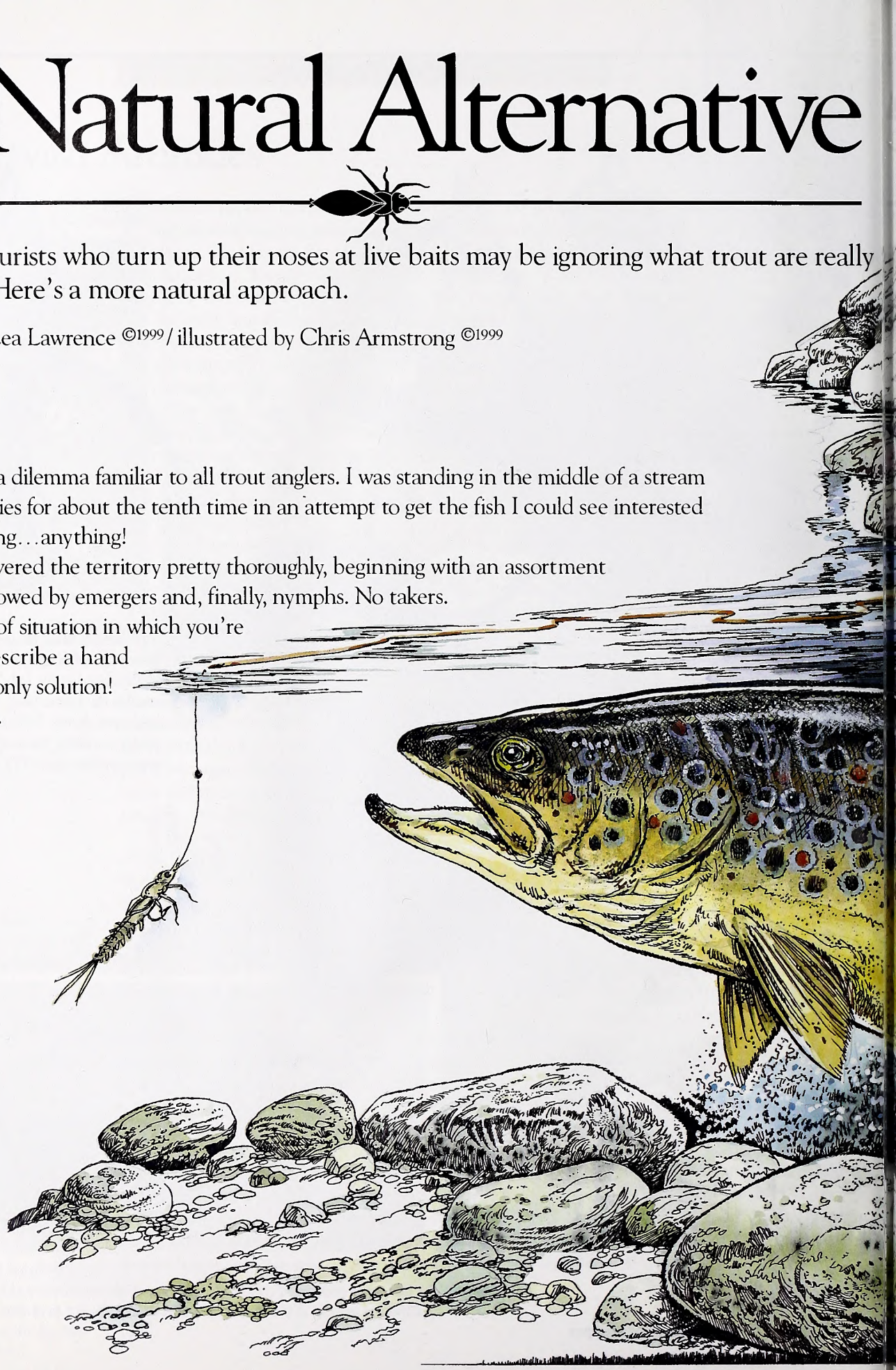
Fly-fishing purists who turn up their noses at live baits may be ignoring what trout are really looking for. Here's a more natural approach.

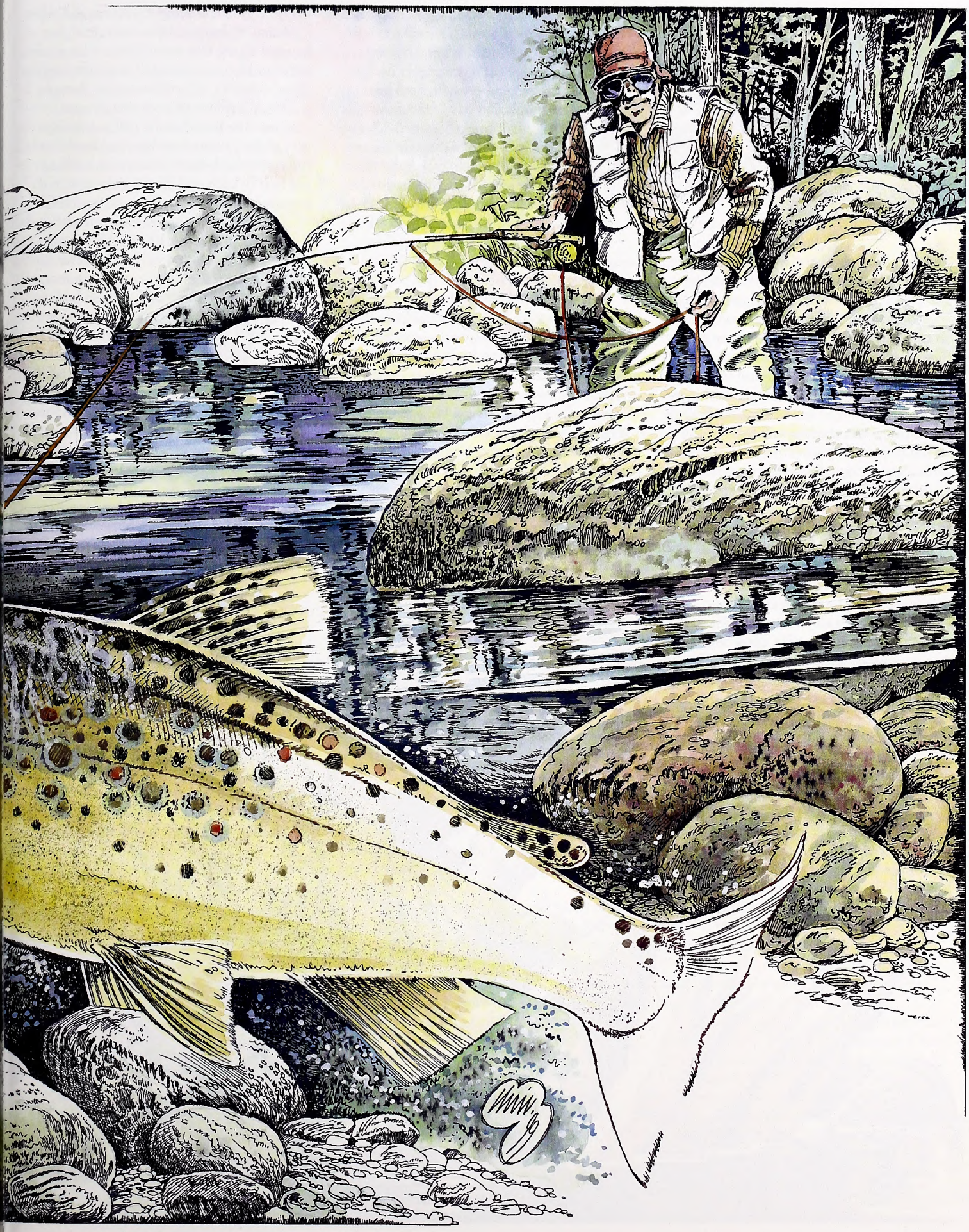
written by H. Lea Lawrence ©1999 / illustrated by Chris Armstrong ©1999

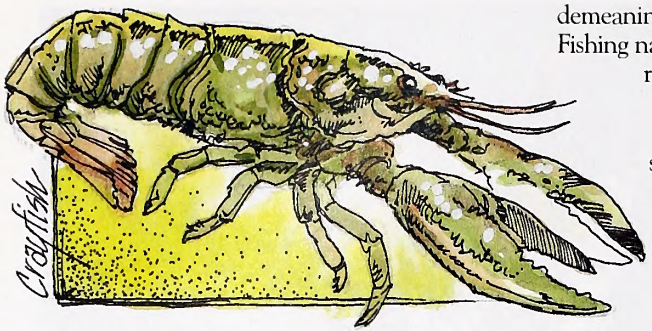
I was facing a dilemma familiar to all trout anglers. I was standing in the middle of a stream changing flies for about the tenth time in an attempt to get the fish I could see interested in something...anything!

So far I'd covered the territory pretty thoroughly, beginning with an assortment of dry flies, followed by emergers and, finally, nymphs. No takers. It was the sort of situation in which you're inclined to prescribe a hand grenade as the only solution!

Well, maybe.







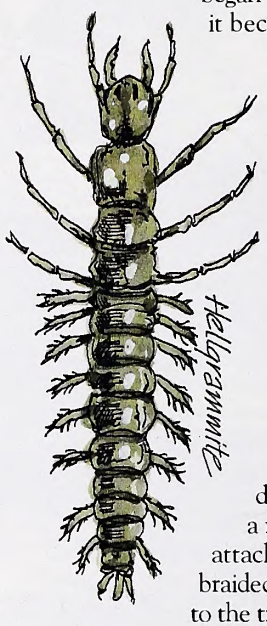
I decided on a slightly less radical approach, but one that I hoped would be just as effective. I switched to the *real thing*—the immature form of the aquatic insects on which trout depend for the major part of their food. These nymphs, or naiads as they are also called, are always present in some stage of their metamorphosis, and in the pre-emergent form, they can be deadly offerings.

At this point, the hair will begin rising on the back of fly purists' necks as they realize I'm suggesting using something other than a feathered creation for taking trout. In fact, that's exactly what I'm going to do, so they'll just have to fuss and fume. Yet it really isn't demeaning to consider such an alternative. Fishing natural baits correctly is an art that requires as much know-how and delicate presentation as fly fishing, and many natural bait specialists are just as finicky and secretive about their methods as the most hard-bitten fly purist. The difference in the two approaches is that the natural bait angler is quite willing to switch to artificials when they'll do the job. In many cases, fly anglers might be better off if their thinking were equally flexible.

By this time it's obvious that, where trout fishing is concerned, I use natural baits as well as artificials. I have great memories of nice catches made with both methods, and there have been plenty of instances where natural baits were my salvation!

Actually, I learned about these stream denizens when I was about 10 years old, before I knew much about artificials. At that time, my family lived in Sylva, in the western North Carolina mountains. My father was an avid fly fisherman, a purist in fact, and he often fished on the Cherokee Reservation with a Cherokee friend named Abe. Dad almost always took me with him, but because my fly box was a Prince Albert can full of red worms, he didn't want me tagging along with him. Abe didn't mind, though, so I became his shadow on the streams.

Now Abe was what I'd call a combination of the primitive and the modern where fishing methods were concerned, utilizing the best of each and ignoring the rest. For instance, not long after he and my father began fishing together, it became apparent to him that a split bamboo fly rod had it all over the willow poles he cut at streamside. My father owned a store that sold fishing tackle, and some trading took place that resulted in Abe owning a fly rod. However, he disdained the use of a reel, preferring to attach the length of braided line and leader to the tip just as he did with the willow pole.



Dad also supplied Abe with a few flies, and for some time I assumed that was all he

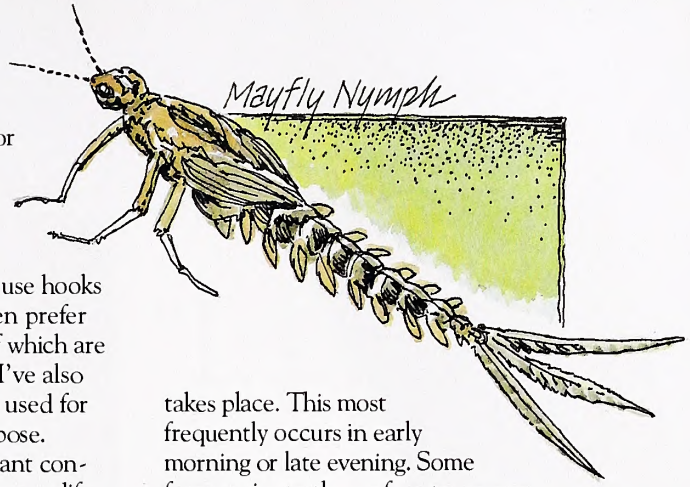
Collecting natural baits *can be as simple as turning over a few stones in your favorite trout stream. The myriad of caddis larvae and nymphs you discover can be used to encourage stubborn trout to bite when artificial flies just won't work.*

used. Apparently he preferred that I think so, too, but eventually I learned this wasn't exactly so. I noticed that Abe would stop occasionally, peer into the water, then reach down and pick something up. When I finally asked him what it was, he replied, "Stick-bait. Real good for trout!" Abe showed me what I later learned was a cased caddis, and as he extracted the larva, he added, "Tip the fly with 'em."

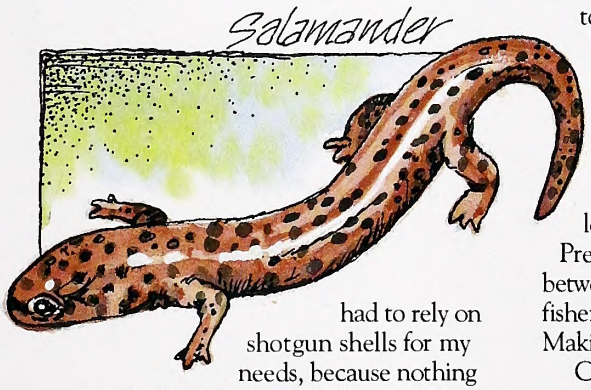
That's what got me started on a path that led to exploring both approaches to trouting, and finding great satisfaction in employing each as circumstances required. Because I truly love fishing with dry flies, that form of the sport is my favorite. But when this just isn't working, I can't resist giving naturals a try.

Of course, caddis larvae are only one of a number of types of immatures found in most trout water. Others include mayfly, stone fly, Dobson fly, crane fly, dragonfly and damsel-fly nymphs. Two other fine naturals outside the insect category are small soft-shelled crayfish and salamanders. All of these except certain forms of the cased caddis are free moving and can be found under rocks on the stream bottom or among debris in eddy water. If you're fishing with a companion, the best way to collect them is to position one person downstream from a stretch of moving water with a small square of screen wire or mesh, holding it in the current. The person upstream turns over rocks, which dislodges the naturals and sets them adrift to be captured in the net. If you are alone, it's a matter of searching rock by rock. In either case, a small jar of water serves as the receptacle for the "catch," but the water must be changed frequently to keep the delicate creatures alive.

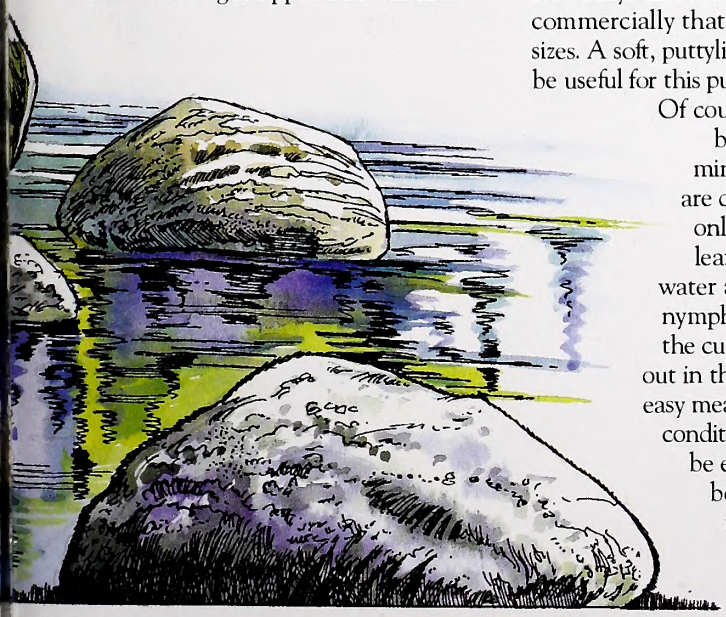
Anglers who fish these naturals usually prefer an 8- to 9-foot fly rod and a long leader with a light tippet that will allow the nymph to drift naturally. Also, the longer rod permits the nymph to be led through a pool or riffle with the water's flow. A floating fly line is necessary to keep visual track of the movement. Because many of the nymphs are quite small, I seldom use hooks larger than No. 14 and most often prefer sizes from No. 18 to No. 22, all of which are barbless to assure easy removal. I've also found that the shank-less hooks used for salmon eggs are ideal for this purpose.



Weight is an especially important consideration, and this is one of the many differences between this kind of fishing and what some classify as bait dunking, where BB shot is standard. Many circumstances require the use of a minimum amount of weight, such as drifting a nymph through a long, slow pool. On the other hand, more weight is needed when fishing fast water, or when one wants the nymph to inch along the bottom. Because of this, it's necessary to carry a good variety of choices. When I first began experimenting with the different weights necessary for these situations, I had to rely on shotgun shells for my needs, because nothing smaller than BBs was sold. I hand-split lead shot all the way from No. 8s to No. 2s. Nowadays there are assortments available commercially that include all of these sizes. A soft, puttylike material can also be useful for this purpose.



Of course, these decisions must be made only after determining what the nymphs are doing, and it usually takes only a little observation to learn this. In high, roily water after a rain, plenty of nymphs will be floating free in the current, and trout will be out in the fast water seeking an easy meal. Under normal water conditions, the immatures may be either under rocks on the bottom or moving upward toward the surface as the transition from nymphs to adults takes place. This most frequently occurs in early morning or late evening. Some forms swim to the surface to emerge, while others crawl up on rocks or other objects. An exception is the hellgrammite, the nymph form of the Dobson fly, which leaves the water and burrows into the earth to pupate. Evidence of most nymph hatches can be seen in their cast-off skins on rocks or floating on the water.



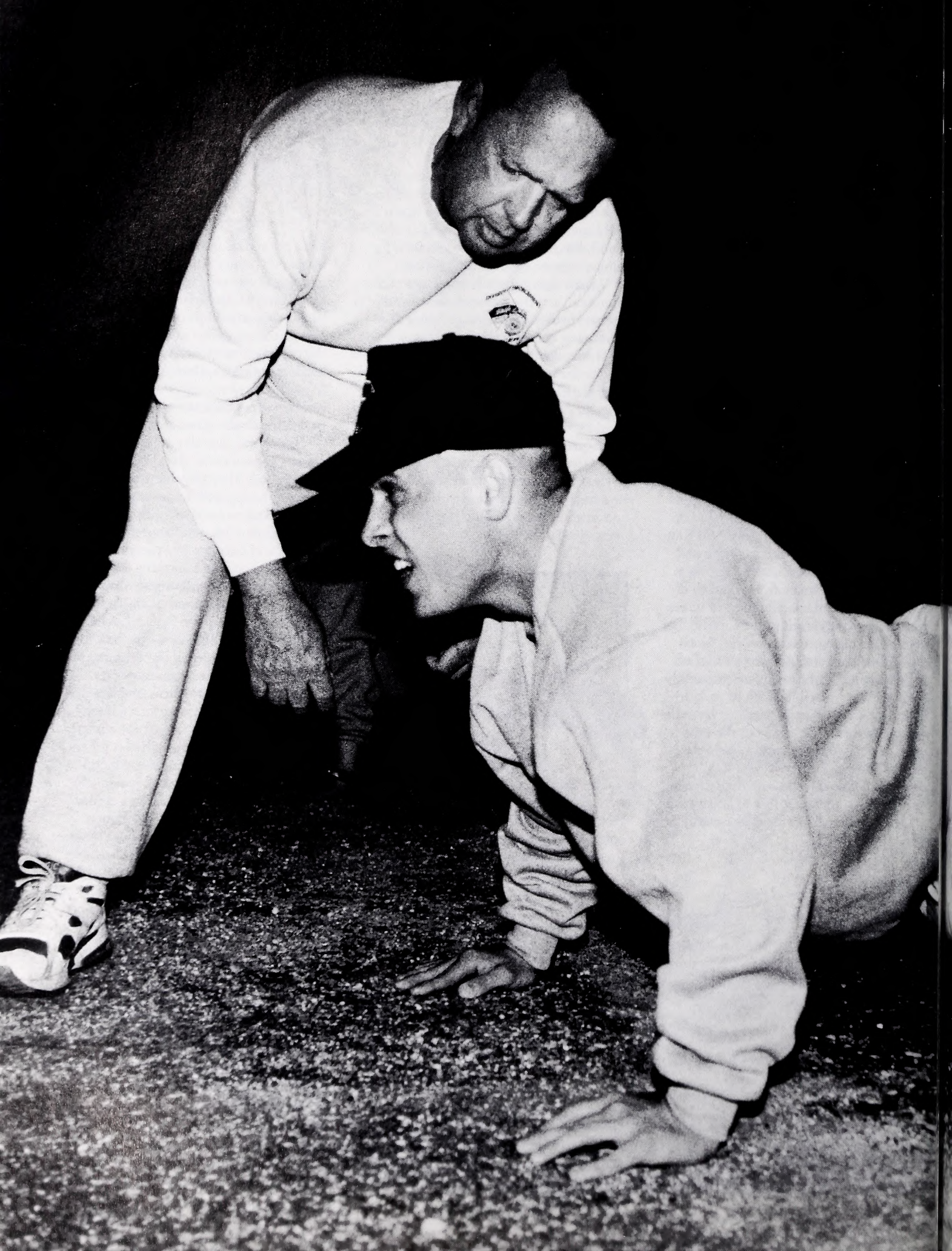
Fishing the naturals properly will almost always produce better than artificials, and for good reason. They are what trout are accustomed to seeing and eating, so nothing about them looks strange when one presents them correctly. An old, wary trout will succumb to the enticement of a natural without hesitation, while anything else would be given careful scrutiny. Too, some of the nymphs with shell-like bodies, such as the stone fly, can be cast fairly effectively. This allows the bait to be presented from a distance, providing longer and more productive drifts.

Presentation can be the main difference between success and failure for a natural bait fisherman, just as it is for a fly fisherman. Making the natural look natural is the trick.

Crayfish and salamanders, which I mentioned earlier as other stream inhabitants on which trout feed, aren't used as extensively by natural bait fishermen. They're what I call "special purpose" baits, which at certain times can be unbeatable. Salamanders are highly effective in the hot summer and early fall months when the water is low. Trout are in the deep pools then, and a salamander drifted into the depths often proves to be irresistible. I've found crayfish to be nearly as deadly during the same period.

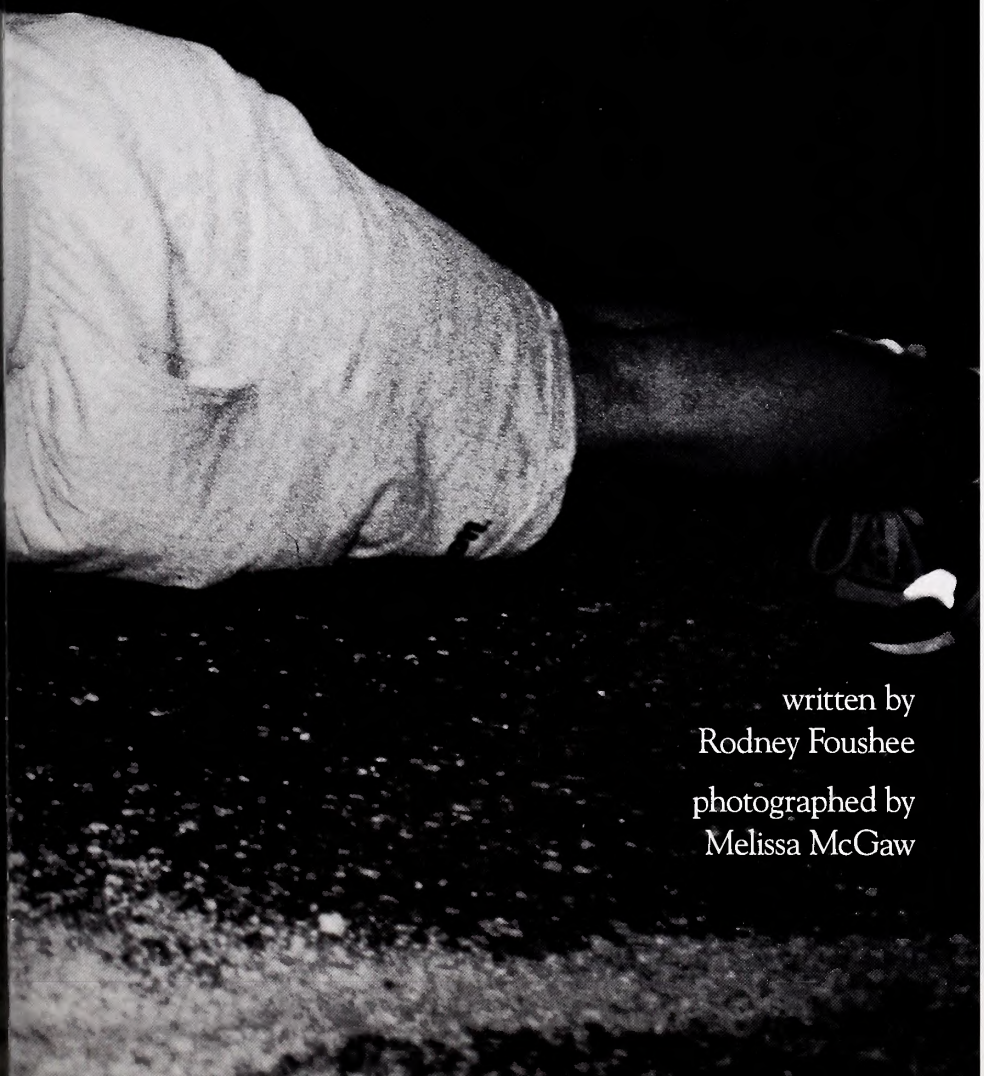
Although the naturals attract trout, their appeal isn't restricted to this category. Other stream and lake fish take them just as eagerly. Hellgrammites and salamanders are famous as top smallmouth bass producers, and the creamy white caddis larvae are bluegill killers!

Becoming familiar with the naturals can make your fishing trip a lot more fun, and certainly more productive. It also increases your understanding of fish psychology, something we all can use. ⊠



School of Hard Knocks

Wildlife enforcement is dangerous work. That's why new recruits undergo a tough and rigorous training that prepares them for the challenges they will face as wildlife enforcement officers.



written by
Rodney Foushee

photographed by
Melissa McGaw

"I want your chest to hit my fist!" Master Wildlife Officer Mike Criscoe barks at the wildlife enforcement recruit in the inky pre-dawn darkness. The weary young man—arm and pectoral muscles quivering from exhaustion—descends a bit lower for yet another push-up.

"Come on, come on!" Criscoe snaps, his fist clenched tightly on the ground below the recruit's chest. "You don't look too happy, but this might just save your life some day!"

At that moment, the recruit doesn't particularly believe Criscoe's suggestion, but nonetheless it's true. More often than not, wildlife officers who work for the N.C. Wildlife Resources Commission find themselves outnumbered and outgunned in remote areas. Statistics show that a game warden is seven times more likely to be killed during an assault on the job than any other type of law officer.

That's why prospective wildlife enforcement recruits undergo such tough training—to ensure they are ready for the challenge.

Each year, the Wildlife Commission receives more than 1,000 applications, from which no more than 20 applicants are selected to attend the Wildlife Enforcement Officer's Basic Training School. Held at the N.C. Justice Academy in Salemburg, portions of the 16-week school are more akin to military boot camp than basic law enforcement training. And that's just fine with Mike Criscoe, one of the school's instructors.

"We push these recruits to reach their potential," he explains. "We only want people who are dedicated and committed. Some of our recruits are just looking for a job, and we've got plenty of those in North Carolina. If they want to join us, they better be looking for a career."

5:30 a.m.

...comes early for the 12 recruits selected to attend the 1998 wildlife basic training school. Each has had up to a year to prepare for the physical and mental rigors of the school. But few, if any, are fully ready.

"Extend to left, march!" Criscoe barks out into the darkness with the fierceness of a drill sergeant. The recruits oblige, moving as one to spread their ranks out and make room for calisthenics in the crisp April air.

Endless push-ups give way to sit-ups,

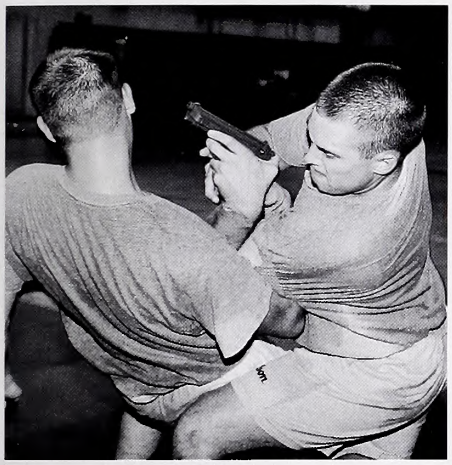
then jumping jacks and mountain climbers. "You've all been sitting on the couch too long," Criscoe yells in disapproval to the exhausted young men.

But the morning exercise is not over; there is still time for a run before the sun rises. Maj. Ken Everhart, a marathon runner, leads the group at a brisk pace. Already spent, most of the recruits have trouble keeping up.

"We don't owe you anything," Everhart yells, his strong legs pumping away. "But we owe the 200 wildlife officers already out there in the field something. We want to send them someone who can carry their own weight."

Relentless physical exercise, martial training and plenty of barracks inspections are the norm for the first two weeks of wildlife recruit school. This is the time when most of those who really don't want to be here will drop out.

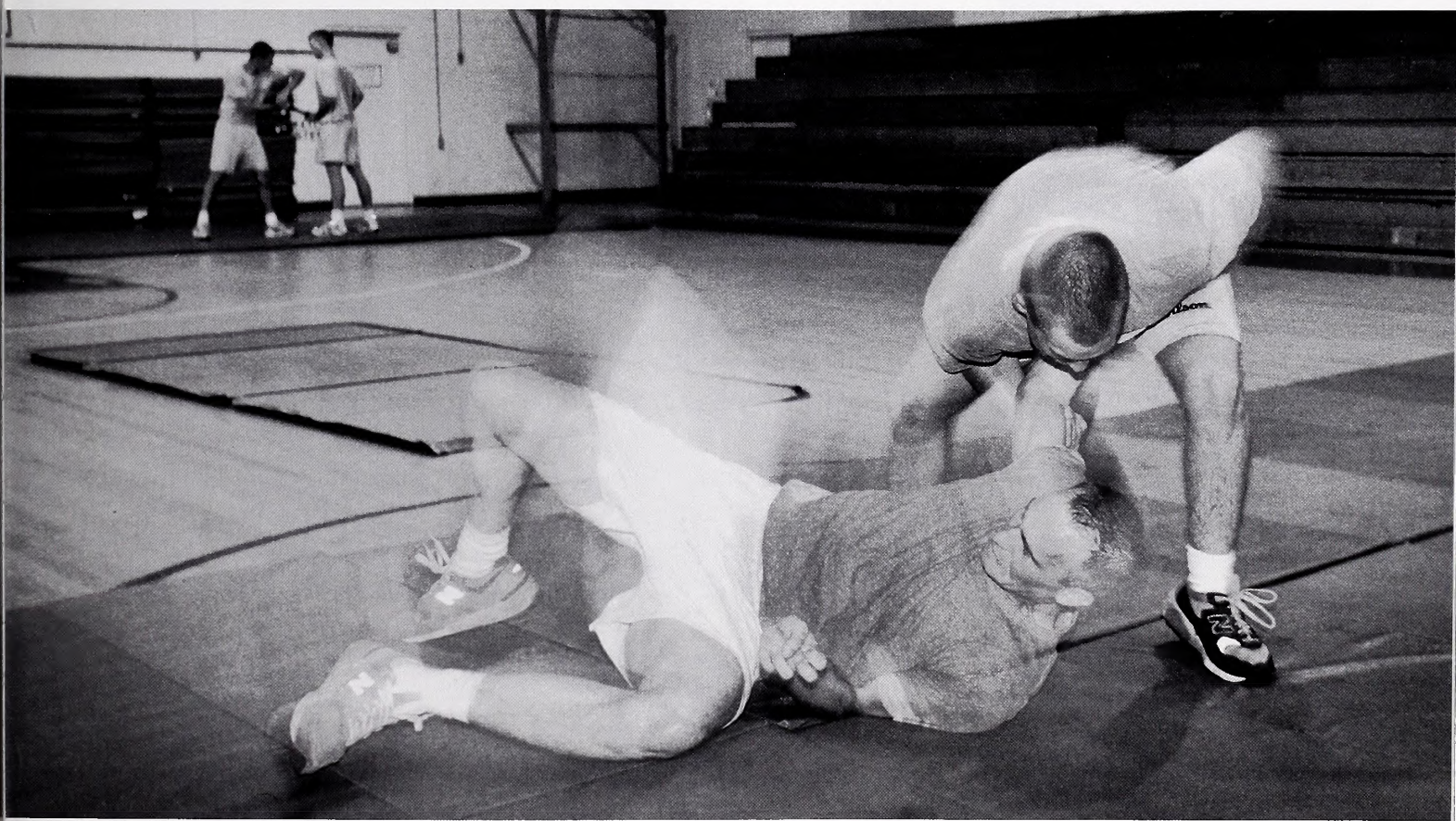
True to form, a recruit leaves the school in the middle of the night during the second week. But the remaining 11 trainees remain and become more confident of themselves and each other as each day passes.



Skills training

. . . makes up the bulk of the wildlife recruit school. This includes 40 hours of firearms training as well as many hours mastering defensive tactics to disarm suspects. Recruits are also taught proper handling techniques for boats, off-road and high-speed chase procedures, water safety and first aid.

Though marksmanship is stressed, the ability to think quickly is more important in the woods, explains firearms instructor Capt. Ken Craft. "I'd much rather have an officer backing me up who's an average shot but doesn't freeze in a tight situation over one who can shoot perfectly at a paper target," Craft said. "The first officer is the one who will save your life."



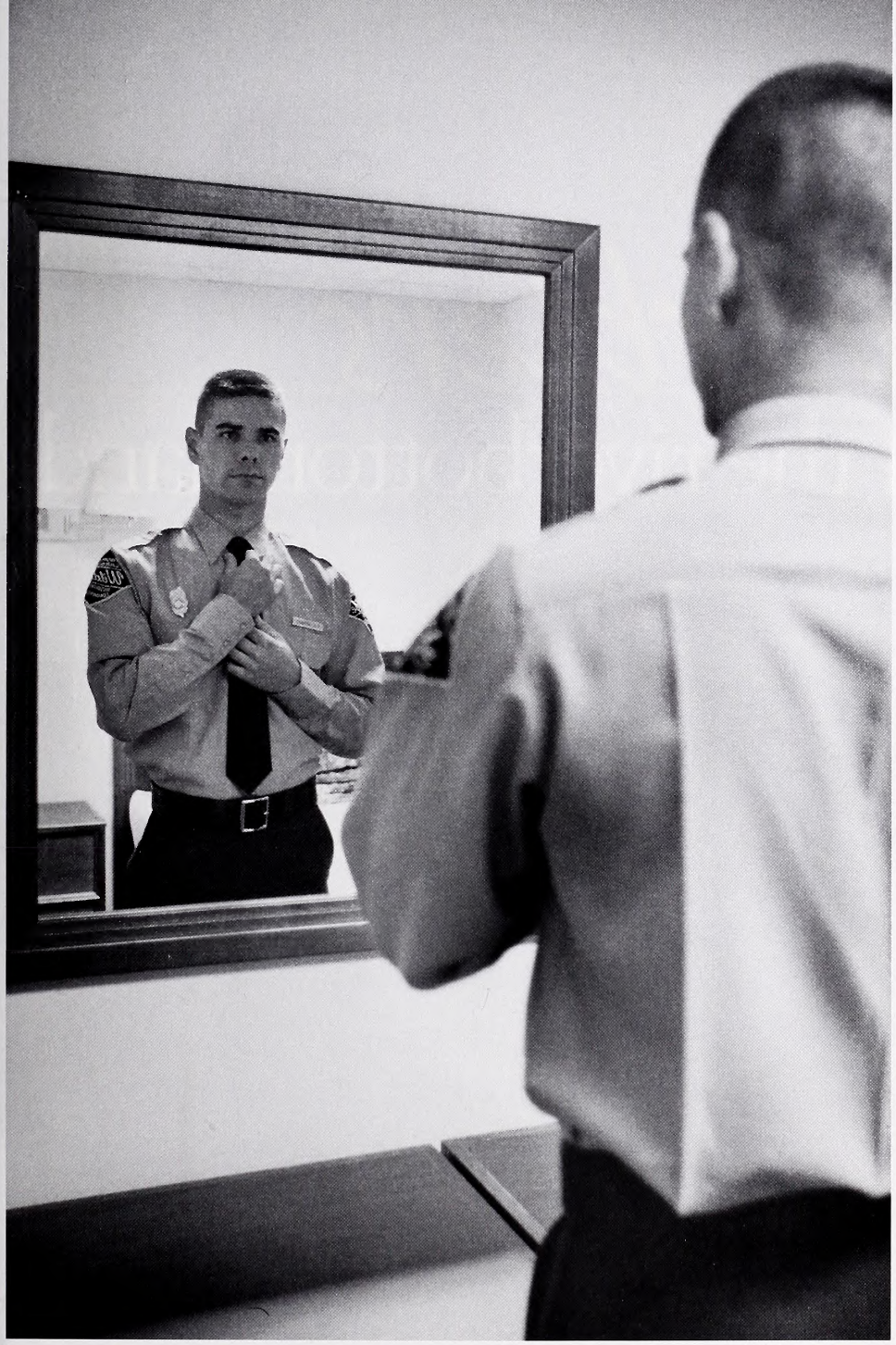
"I'd much rather have an officer backing me up who's an average shot but doesn't freeze in a tight situation . . . . "

A wildlife officer

...has to be both physically and mentally prepared for the job. That means plenty of classroom training as well.

Recruits have to learn the basics of law enforcement—evidence collection, report taking, investigations, arrests and criminal law as well as unique aspects of wildlife law including the identification of dozens of game and fish species sometimes by using only body parts alone. Recruits also learn how to deal with wild animals, detect illegal baiting and other field tactics. All of this knowledge is tested on a final exam—one that must be passed during the last week of the school.

"We want to send them someone who can carry their own weight."



So You Want to Be a Game Warden?

Though the jobs are few and competition is keen, a qualified, committed applicant can make it through the selection process and attend the wildlife officer's basic training school. Many recruits accepted to the school are college graduates and/or military veterans.

Applicants are initially screened, and then must pass a physical agility test, followed by a public safety test and swimming assessment. If they pass, a background check and interviews are scheduled. Following the successful completion of these steps, applicants undergo physical, psychological and drug tests. Only the most qualified applicants are invited to attend the school.

For more information, contact your local wildlife officer or call (919) 733-7191.

Sixteen weeks

. . . of grueling training culminate in one event—graduation. For the first time, the recruits are permitted to wear the uniform of a wildlife officer. Proud family and friends are there as each new officer is recognized for his accomplishment. Each will be assigned to work in a different county across North Carolina for six months under the guiding wing of a veteran officer. But 11 shiny new badges bear testament that these men can now stand proudly with their trainers as North Carolina Wildlife Resources Commission enforcement officers. ⊠

warblers
of the riverbottom lands

In the springtime bottomlands of the Yadkin River that once echoed with birdsong, there was ample chance for a youngster to discover the natural world.

written by John Trott ©1999

"One never forgets one's first warbler!" wrote the great warbler-loving ornithologist Frank Chapman in 1907. This, of course, is still a fact, as true now as it was when he wrote it.

The memory of seeing my first warbler in brilliant breeding plumage is with me now, as vivid as when it occurred. I heard its song first. The loud "Come to the woods or you won't see me" exploded at me from a swampy forest near my home in Stanly County. The tantalizing song punctuated the soft air of late April. I had heard nothing like this song before, and so I stopped and stood beside my bicycle, waiting.

Spring comes early in central North Carolina. The new leaves on the trees were of a soft yellow green, so tender and vulnerable they could break the heart of a 13-year-old obsessed with birds. The abrupt song came again, nearer this time. Something kept me from moving, from going in search of the singer. I stood on the dirt road, holding my bicycle upright beside me.

A limb of a tulip poplar hung over the road, its tip not more than 3 feet from my face. Suddenly a bird of startling beauty appeared on this branch. It had a luminous yellow face-mask surrounded by a jet black hood that covered its head, throat and upper breast. A hooded warbler! The bird threw back its head and hurled the loud song into the spring air. I can still feel the exhilaration—the exaltation of spirit—of that experience.

During my high school years, as I explored the river bottom forest along the brown and sluggish Yadkin River, the song of the hooded warbler became a familiar part of every spring. The bird remained elusive and difficult to see. Mostly it was a voice in the woods.

I left home after college but years later I returned and taught school. There was illness in the family and I was needed. Teaching was my profession and my love, and there were always the birds.

I was out of touch with my contemporaries who had stayed in the county, but a number of seventh-grade students responded to the fact that I could teach nothing—history, English (especially English) or, of course, science—without somehow inserting birds and the wonders of the natural world. On Saturday mornings, when a troupe of six or seven boys and girls could get away from farm chores, I would round them up and head for the river. After parking the car under the great bridge spanning the Yadkin, we walked among the giant tulip poplars, red maples and ironwood trees that grew along the riverbank. The 12-year-olds were full of wonder. On our left, rising steeply from the narrow dirt road, the woods rose upward, and the undergrowth was more dense.

I had discovered this remote and wondrous place when I was in high school, and I would frequently explore it for hours. I had the first edition of Peterson's *A Field Guide to the Birds*, but binoculars were not available. I wanted to see the birds that made every sound, so I learned patience. I stalked and sat

Spring is a good time *to see warblers in their bright, fancy dress. The males are bolder and more aggressive, making them easier to spot. The Kentucky warblers (left) and the American redstarts (below) breed in bottomlands, beginning in April.*

JOHN TROTT

MASLOWSKI PHOTOGRAPHY

MASLOWSKI PHOTOGRAPHY

***Summer tanagers** (left) and prothonotary warblers (above) are also found in bottomland habitats. Unlike scarlet tanagers, the male summer tanagers retain their bright plumage throughout the year.*

and waited until the birds were revealed: the lemon-breasted and black Kentucky warblers, vermilion summer tanagers, russet-backed wood thrushes, and, most startling of all, the prothonotary warbler—a bird not yellow, not orange, but gold. The memory of finding this bird for the first time flows through time to fill me with wonder and exhilaration as fresh as when I was 14.

So I returned to the river with the young naturalists. They found and heard everything, and I was young again, reliving the excitement of my own awed astonishment at this new world.

I felt a close kinship with one member of the group. Clay was quiet and had a puckish sense of humor. He reacted with intensity to all he experienced on that narrow road along the Yadkin. He was an only child, and his family was poor. Only Clay's grandmother recognized the alert intelligence of this boy and nurtured his fascination with birds. He had come to birds on his own; I never knew when. I knew that he had heard the ethereal song of the field sparrow as it sang at night, and that he had found a meadowlark nest in the field that surrounded his small farmhouse. He told me of these things in his shy, diffident manner after school, when he was waiting for the yellow school bus to take him home.

Clay was a quick, bright student and always finished his schoolwork before his classmates in the seventh-grade classroom over which I presided. One cold January day, I saw Clay put down his pencil and slowly extricate his copy of *A Field Guide to the Birds* from his desk. This had been a secret gift from his grandmother, procured by me at her request. She said, "I want a good bird book for that boy." Other than this gift, there would be no place for birds in Clay's life; farming and working in the cotton mill would be the limited boundaries of his future.

Clay opened the book to the plate that showed Peterson's paintings of warblers. From my place at the desk, I saw him study each picture, then put his finger on one and glance up at me. I went to his desk. He had his finger on the prothonotary warbler. "Will I see that bird?" he whispered. So as not to disturb other students who were, after all, supposed to be doing long division, I wrote in his notebook, "Yes, along the Yadkin in April."

At recess that morning, there was a rush for coats and jackets, a stampede down the hall and out into air, which was as cold and clear as spring water. When I started to put on my own coat, I noticed that Clay was still at his desk with the bird book open. He got up and brought the book to me. "This one?" he asked, pointing to another warbler, the bird with a yellow mask.

I wasn't quite sure what to say. I was reasonably sure that we would get the opportunity to see the

JOHN TROTT

***The common** yellowthroat builds its nest in low bushes, often just above the ground or over water. An immature male, like the one above, will soon sport its characteristic olive-yellow plumage.*

prothonotary warbler, for it nested in the dead river birches standing in the water. We'd hear the loud, emphatic *tweet-tweet-tweet* and soon after, a bird would leave the undergrowth and, with undulating flight, come into view on the nest tree. The upper back and head of the male prothonotary was sunlight captured and transformed into feathers. But I didn't know how to tell Clay that this other bird he was asking about, the hooded warbler, did indeed sing and nest in the low shrubs along the river, but usually was just a tantalizing voice in the woods. Seeing this warbler was no sure thing. In the face of Clay's enthusiasm, held in tight control, I decided it was best to be truthful. He would hear the bird, I told him, but I could not promise he would see it. There was a period of silence. "I'll see it," he said. "And I will find the nest." I checked my cautionary words. Knowing Clay's infinite patience and determination, I concluded that indeed he might find a hooded warbler nest.

March came to central North Carolina. Students found the first hepatica among the leaves, and the buckeye revealed yellow flowers. At the end of the month, a black-and-white warbler searched and probed tree trunks for insect eggs. In April, the Louisiana waterthrush sang its wild and jubilant song from stones of a creek that flowed and blended into the brown waters of the Yadkin. I commented that there would likely be a nest under the fronds growing on the steep bank. Waterthrushes return first and nest early.

Soon one of the girls discovered trout lilies and called for us to see them. They were beautiful, with their mottled leaves and buttery yellow petals rolled back to attract early bees carrying off loads of pollen to another flower.

Clay was not with us. I was not concerned, for he often wandered off by himself in search of some new mystery or to satisfy himself about a sound a bird had made. I was right; when we returned to the place where the waterthrush sang, he was there, standing on the creek bank. He motioned for us to be quiet and whispered that we should move slowly. The waterthrush was scolding with hard, abrupt chips. Clay had discovered the nest, tucked under overhanging fronds, impossible to see without lifting the ferns. Now the bird was incubating eggs.

Suddenly, we heard the enticing song of the hooded

MASLOWSKI PHOTOGRAPHY

MASLOWSKI PHOTOGRAPHY

***The yellow-rumped** warbler (above) is a common winter resident in North Carolina that migrates as late as mid-May. The bird eats insects, often taking them on the wing just above the water surface. The black-and-white warbler (left) sometimes breeds in bottomland swamps. Wood thrushes (facing page) are also swamp nesters, but they build their nests in trees like robins.*

warbler far upriver. The bird sang twice and was silent. But it was time to leave; the shadows were long. I would be lucky to deliver the students to their homes in time for their evening chores before supper. When I dropped Clay off at his home, I asked permission from his parents to have him help me carry equipment and put up the blind when I returned to photograph the waterthrush nest.

Shortly after dawn a few days later, the air tender and soft with early May, I waited for Clay where the dirt road to his house met the paved county road. The morning air was full of the song of field birds. I first heard and then found the grasshopper sparrow. Its insectlike buzz came from a tall bit of grass quite near the car. Through my binoculars I could see the little bird with head thrown back and bill open; from this came only a buzz. The robust song of a meadowlark soared out over the field. The bird was in the very top of a large red cedar. As Clay started up the road from his house in the middle of green fields, the meadowlark stopped singing and sailed out over the field.

When Clay reached the car, he turned back toward the field, pointed and said, "Meadowlark's

got a nest down there. I've been watching from the porch, and they always fly down at the same place. Shouldn't we look for it?"

It was a dilemma. I had long wanted to set up a blind and try to photograph meadowlarks at the nest. The birds were wary and watchful, difficult to fool even with a blind. Here was my opportunity, but the waterthrush was at the river. Waiting often does not work with birds; the seasons progress, and predators are alert. We were both silent for a time. Finally I said, "Which would you rather do?" Clay got in the car and closed the door. "The river," he said, and nodded as if to emphasize the rightness of his decision.

Finally the blind, covered with burlap, was in place at the waterthrush nest. One of the pair scolded us continually while we worked. With the flash on a tripod between blind and nest, and a low stool installed, I was ready. But the birds had to have time to accept the blind and go on about their business of feeding young. Clay and I walked upriver. Soon we found ourselves farther upriver than I had been before. We were on a broad floodplain dominated by giant tulip poplars, which soared up and over the mayapples covering the ground. Through the alders on the riverbank I could see the brown water of the Yadkin.

I stood for some minutes looking for a wood thrush whose song I heard. The song of the wood thrush has a heart-stopping beauty for me. The clear liquid notes, cool and serene, floated down from the poplars. Then I heard a sharp, distinct note of protest and turned to see a male hooded warbler flitting through a spicebush not 3 feet away. He spread his tail, revealing the white outer tail feathers, and flitted through the shrub, calling repeatedly. Another warbler, the female, appeared just over our heads in a dogwood. She did not scold and continued to stay farther away than her mate. She had a bright yellow breast and an olive-green back, with just a hint of the black hood.

Clay was not far ahead, and I called to him. There was a nest nearby. We began to search the undergrowth. No matter where we looked, the male continued to scold with a musical *tchink*, spreading his tail all the while. We searched the upright crotches of nearly every shrub within a 20-foot radius. After 10 minutes or so, the female disappeared.

I became discouraged and began to think that the young had left the nest. It was very early in the season for this to have occurred, but it was a possibility, and in our search we could easily step on the fledglings. I was beginning to consider calling a halt when I heard Clay say, "Here!" He was crouched down at a tulip poplar sapling not more than 3 feet tall, and he was 40 feet from where I had been standing when the male began to scold. The nest was 2 feet from the ground and was attached to two upright branches. Woven of plant down and bits of leaves, the deep cup contained four eggs, each with a circle of brown spots near the large end. The female appeared and flew close to us. She joined her mate in scolding, both circling us.

To mark the spot, I tied a bit of tissue to a shrub growing close to the one containing the nest. Perhaps I could return and take pictures when the young hatched. We moved away, and the female immediately returned to incubate her eggs. The male continued to scold until we were 20 or 30 yards from the nest. Clay borrowed my binoculars and spoke of his wish to stay and watch. I returned to our almost forgotten blind to photograph the waterthrush nest.

It was a moment of magic not only for Clay, but also for me, watching him discover the nest and fulfill his promise to himself. Now, 30 years later, the exuberant song of the Louisiana waterthrush is no longer heard on the bottomlands of the Yadkin. Lustrous yellows of countless trout lilies and the face of the hooded warbler exist only as memories. Kentucky warblers no longer punctuate the spring with their emphatic songs. Within a few years of Clay's finding the hooded warbler nest, a dam was built downriver, and the rich bottomlands were covered by turbid brown water. I must cross this river on my infrequent visits to my hometown. I keep my eyes straight ahead as I cross the bridge. ⊠

John Trott is a writer and photographer from Flint Hill, Va. A different version of this article was previously published in Bird Watcher's Digest.

NORTH CAROLINA NONGAME & ENDANGERED WILDLIFE FUND

Return the Gift

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JOHN TROTT

ANN CARY SIMPSON

Not a WHOLE LOT of HIGH GROUND

Nestled between the converging Black and Cape Fear rivers is a primitive swamp where dry land is as scarce as water in the Sahara. Meet Roan Island, one of the Wildlife Commission's newest game lands.

written by Bland Simpson ©1999

CURTIS WOOTEN

"Roan Island?" said the old timberman in Pender County's Canetuck Township. "That's a bad place to get to." Not a bad place, now—just a bad place to get to.

Roan Island sits mighty low in the water at one of eastern Carolina's great drains, the confluence of the Cape Fear River and the Black River just a few miles northwest of Wilmington. Outside of its immediate swampy area, Roan is one of our state's least-known inner islands—though at 2,757 acres and with dimensions of 4 miles by a mile and a half, it is nearly as large as one of our best-known, Harker's Island up in Carteret.

Owing to a January 1998 land-preservation deal, the big swamp island has now come into the common weal. The North Carolina chapter of The Nature Conservancy bought 2,132 acres of Roan from its long-time owner, Wilmington's Corbett Farming Company, with a $1 million grant from the Natural Heritage Trust Fund. Corbett Package Company donated the remaining 625 acres to the conservancy, which then transferred the whole island to the N.C. Wildlife Resources Commission for management as a public game land.

Only a boat will get you there. No bridge leads to it, and only a handful of rough, private lanes even lead to within sight of it. As you drive down into the stout neck of land between the Cape Fear and the Black, you can feel, and see beyond the broad fields, the land dropping away below and before you. The names of the two-lanes in that neck reveal its character: Steel Trap Road, Light Wood Knot Road, Canetuck Road. In late fall, the tall cypress along the creeks stand out a rusty gold beyond the great eastern farm fields. My wife, Ann, and our little girl Cary and I were bound one November afternoon right down to the center of that land above Roan Island, through fields that were not so very long ago swamps themselves, till Lyon's Creek was worked into Lyon's Canal and the drained swamps and branches were worked into farms.

Ted Brown, an affable forester we came upon along Heading Bluff Road south of Currie, said of Lyon's Canal: "If it hadn't a been dug, there wouldn't be any farming in this whole section—it'd all be swamp."

We enjoyed as best we could a near-vertical put-in at the Heading Bluff Road bridge over Lyon's, a maneuver that was a piece of cake, albeit an unleavened and thin-sliced one. Our johnboating was in the dugout creek for a mile or more, and then for the last mile to the Thoroughfare (which runs between the Cape Fear and Black rivers on Roan's upper end) we were in swamp, on what remained of the natural creek. We were passing 3- to 4-foot cypresses, a few saw palmettos and sycamores on the way down. Whenever we killed the little Johnson outboard and just floated, we would hear a kingfisher splitting the air somewhere near, and woodpeckers aplenty were out knocking and chopping away at the swamp forest, their tattoos carrying sharply through the woods as if they were calling it to order.

If they were, it was the order of a primitive nature. For Roan Island at the Thoroughfare was a jungle, the vine-tangled capital of the Cape Fear lowlands and the Black River valley, a wild, wet spot harboring alligator and bear, deer and otter, songbird and wild turkey, as well as more ancient, thousand-year-old cypress for which the Black is justifiably celebrated. Roan is now the anchor for The Nature Conservancy's Black River basin-wide protection effort—the lower end of its wildlife corridor, the last lonesome land before the big riverport of Wilmington downstream. The Conservancy's Fred Annand called this island "a real treasure...the result of careful management and its isolated location at the junction of a blackwater and brownwater river," acknowledging that Roan Island's position made it a unique environmental gauging station. Here was The Nature Conservancy's southeastern counterpart to its bottomland conservation work farther north in the Roanoke River valley.

It had come to us North Carolinians with a cost, though, and not just the one represented by the price tag. Those dozens who had braved the wild island as members of the Roan Island Hunting Club and learned it and negotiated its trackless interior—some of them for nearly 40 years—now lamented the passing not only of their hunt but also of the stewardship it entailed. Last year, they worried aloud to the press that the absence of a bona fide hunting club and its posted signs and its patrols would lead to free rein for poachers and the diminishment of the island's deer population. Somehow, the state would have to honor the club's late and long-standing presence with a strong stewardship of its own.

Much to reflect upon, as Ann and I brought the johnboat out of the swampy tangles, out from the pure reflection of forest in the black water of Lyon's Creek into the openness of the Thoroughfare. We plied it first down toward the Black and after a

***Adventurous travelers** can reach Roan Island by following Lyon's Creek into the Thoroughfare, which links the Black and the Cape Fear rivers and forms the northern boundary of Roan Island. Dry ground is at a premium in this primitive swampland where alligators are sometimes seen.*

MELISSA McGAW

Roan Island's *bottomlands contain hardwoods (left) as well as baldcypress trees (right). Deer and wild turkeys are found here as well as otters, mud turtles and other nongame species. The Wildlife Commission acquired this wetland prize with the help of the North Carolina chapter of The Nature Conservancy. The Commission manages Roan Island as a public game land.*

KEN TAYLOR

ANN CARY SIMPSON

while up toward the Cape Fear, spooking the occasional wood duck, alarming a turtle, out for some late-season Sunday sunning, off its log. We weren't in the middle of nowhere, for we had company: cardinals, crows, buzzards. And along Roan's overgrown banks the big trees loomed.

When I spoke later with Eddie Corbett—whose Wilmington firm made the Roan deal with Annand—he marveled over one of the island's biggest trees, a low country wonder he'd spotted from the air a few years ago. This was a double-trunked cypress growing up like a tuning fork, with each of the twin trunks appearing to Corbett from his helicopter's-eye view to be a good 8 feet in diameter.

"Did you ever walk to it?" I asked.

"No-o-o-o," he said. "It'd take GPS to find that thing. I've flown over the island in a small plane a couple times since then, and I've looked for that cypress. Didn't see it either time. I don't know but, with the storms and all, it might've blown down. No telling how big the main trunk below that pair might be!"

It was Corbett who directed me to Milvin Marshall, the aged timberman who, by Corbett's reckoning, knew Roan Island

just about better than anyone. Marshall now lived by himself on the Heading Bluff Road by Lyon's Canal, not far from where Ann and I had put in last fall. He had a high-pitched, lively and emphatic voice, kind of like Walter Brennan when excited. Yes, he answered my question, he did have a recollection or two from his Roan Island tenure many years ago.

"We cut timber all over Roan's Island, off and on for 10 years or so, we sure did," he said, "except in the middle where we couldn't get it out. Cypress, black gum too, and sweet gum, tupelo gum...some elm, a few sycamore along the riverbanks."

Milvin Marshall and his brother Hailey used to rough it on Roan at the mouth of Black River, where they had themselves a 12-by-12 camp. "We'd go down there by boat, stay maybe a week at a time. Carried meal for corncakes, and eggs...set a trotline, catch cats, skin 'em and eat 'em."

"Any other fish?" I asked.

"Perch, trout, largemouth bass. We'd kill squirrels in the wintertime, or coons, anything we could get. We fared good!" he laughed. "We were just as healthy as bulls!"

No wonder. These waters were legendary fishing grounds, as Carolina Beach outdoorsman Richard Cecelski said: "That whole area's known for monster cats!" And sturgeon thereabouts have weighed in at as much as 400 pounds.

"How about bear?" I asked Milvin Marshall. "Run across many of them?"

"Never—wadn't bothered by bear. Had some bobcats, though." Of his main reason for being out there in the wildcat woods, Marshall said: "We used to work timber from Elizabethtown right on down, on Roan's Island for Corbett, for Southern Box. We'd deliver it to Wilmington."

When I asked him the name of his company, he just laughed again. "Didn't have no name...just Marshall brothers, I guess."

Working Roan Island. "Somebody might've had a dinky train there," he said, but he wasn't very sure of that. For the Marshalls the work was always by boat and by hand; they cut timber into 3-foot and 5-foot blocks, then rowed it out and rafted it up—and the rafts they made of Roan timber were enormous, their biggest topping out at 89,000 board feet. To drift them downriver, he said, it would take "three and a half to four tides to carry 'em to Wilmington." The Roan Island and lower Black River swamps are at sea level, and the Black is known to be tidal as far upriver as Point Caswell, most of 10 miles above the Black's confluence with the Thoroughfare.

"I wish I had it now, that timber, the price it is now. I'd be heeled over—with money!"

Marshall's fondness for the isolated

ANN CARY SIMPSON

island, though, went far beyond the woodsman's economy he'd once been part and parcel of. "Nice scenery," he said. "Wild territory. There're big cypress shells, where they couldn't get to it, and a 6-foot cypress would be common. Been 20 years since I been out there," he said. "Used to be a lot of deer, coons, possums—I don't know what's out there now."

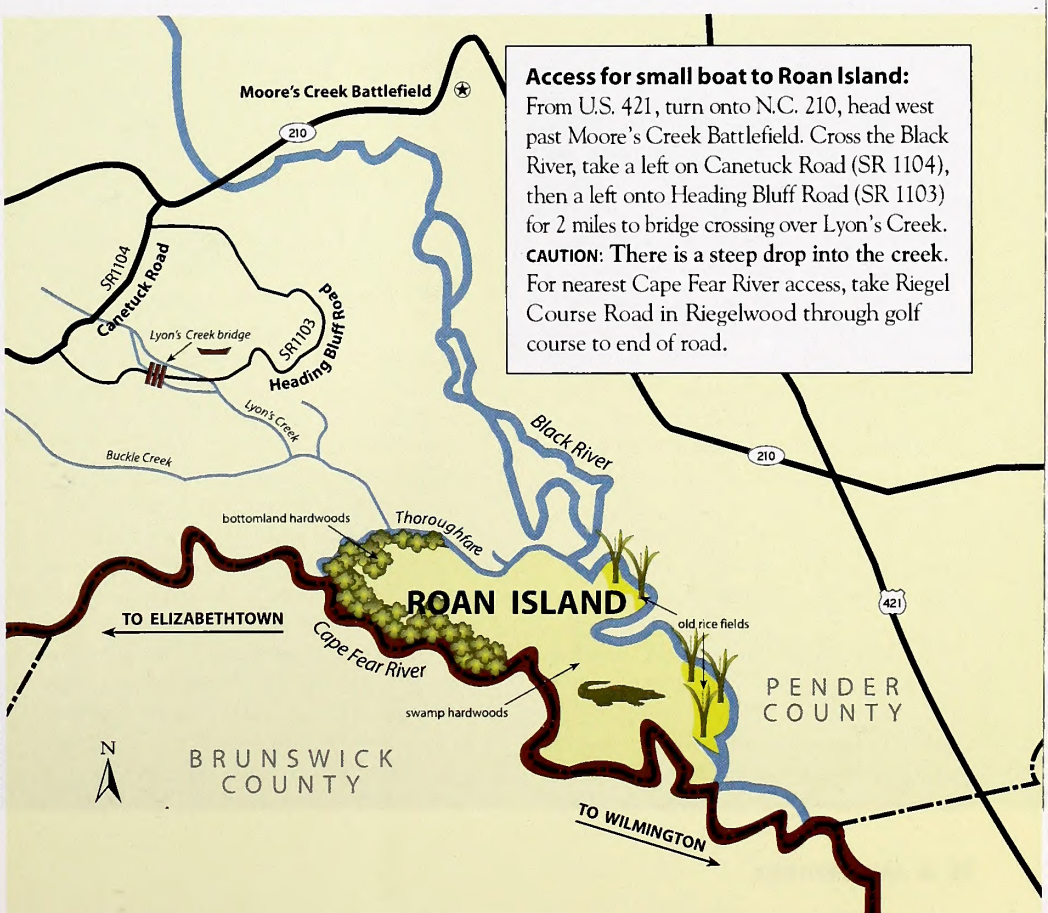
Years back, when he had known it, he had indeed known it well. "Never got lost," he said. "I was like a coon...raised up here in Canetuck. More of a varmint than anything else...we were tough as alligators."

I asked him to give me some soundings on the footing in the island's interior, and Marshall said: "Well, there's some high ground along Cape Fear River, along the Thoroughfare. But you haven't got a whole terrible lot of high ground." Bottomland hardwoods take what high ground there is, in a lazy C from about a half mile east of the mouth of Lyon's Creek into the Thoroughfare, around to where the Thoroughfare hits the Cape Fear River, and then about a mile downriver to the east. A couple of Roan Island marshes show up as old rice fields on maps of the island: one along the Black just above the confluence with the Cape Fear, another farther up the Black and filling a tooth-shaped loop between Peachtree Landing and the Thoroughfare's mouth.

As for putting a small Roan-bound boat in anywhere even vaguely proximate to that island, somewhere closer than the Riegel Course Road ramp 5 or 6 miles up the Cape Fear, or closer even than the Heading Bluff Road bridge, Milvin Marshall laughed yet again and said, "Well, I don't know—where you were on Lyon's Creek, that might be the nearest point."

So by the old timber-drifter's estimation we had done as well as we might have, and had been to the head of the beast, if not yet to its belly. Ann and Cary and I rode on home to the Piedmont, into a big, bright red and gold sunset, with a taste of Roan and with a taste of Bladen County as well—a tin of Houston's blistered peanuts. A circumnavigation of Roan Island would have to wait, as would a laying of hands on that mythical double-trunked cypress. That was all right, I thought, and it was stuff enough for springtime dreams to be made on. ⊠

Chapel Hill writer Bland Simpson is also a member of the famed Red Clay Ramblers. His latest book is Into the Sound Country, *published by The University of North Carolina Press.*



MAP BY ERIN HANCOCK

Ten Turkey Turnoffs

Gobblers survive your best efforts each spring because they can count on you making mistakes. Eliminate some of these classic goofs and you just might get lucky.

written and photographed by Gerald A. Almy ©1999

Most articles about turkey hunting try to give readers advice about tactics they can use to harvest this elusive spring quarry. Though that is important, sometimes the best way to be successful at this challenging sport is simply to avoid mistakes.

I feel qualified to write about this subject because in more than 25 years of hunting spring gobblers, I've probably made every mistake there is. Some of them I've made more times than I care to admit. But after doing the wrong thing repeatedly, I've learned to avoid the most common mistakes and my success has improved as a result.

Even if you're flawless, don't be disappointed if you can't make a gobbler come hither. Only a small percentage of North Carolina hunters are lucky enough to harvest a tom in a given year, although they enjoy being out there in the woods as spring reclaims the land after a long, gray winter.

But for those who do lure in a long-spurred tom, their success has come about mainly from avoiding many of these 10 common mistakes:

1 Driving too close to the hunting area. If there's little pressure on the birds where you hunt, this may not be a problem. But where most of us hunt, turkeys are pursued heavily, and they often become wary if they hear car doors slamming, engines shutting down and hunters talking. They may actually fly off, ruining your hunt, or they may simply clam up and be too suspicious to come in to your calls.

To avoid this, park at least a quarter mile away from where gobblers might be roosting, shut vehicle doors quietly, then walk in. Also, if you're driving around later in the morning trying to locate birds, park the vehicle some distance from likely hunting spots. Then, walk up to them and call, rather than stopping and calling right next to the truck.

2 Not doing enough preseason scouting. Since male turkeys are vocal in the spring, some hunters think all they have to do is go out Opening Day and listen. That might work occasionally, but a better approach is to scout the property a few weeks before the season opens and try to locate several different birds in advance. You can't just show up anywhere and count on hearing a turkey. By doing some backwoods driving and lots of walking, though, you can line up several areas with toms, and chances are good some will still be there Opening Day.

This is important because the spot you plan to hunt may have other hunters there when you arrive. It's also possible that birds in your first hunting area won't cooperate by gobbling, but those in another spot will.

But don't scout too early. Ten days to two weeks before the season is about right. You want to wait until late winter and early spring, when the flocks have broken up and the birds are establishing their breeding territory.

A good way of covering a lot of territory is by driving dirt or gravel roads on public land or in areas where you have permission to hunt. You should stop every 300 to 400 yards, walk a short distance from the vehicle and call. Also, hike out ridges and logging trails in prime areas, listening for birds. Use locator calls such as the owl, crow, hawk or pileated woodpecker, as well as hen calls. Avoid drawing a gobbler all the way in with your turkey calls, though. You simply want to locate the birds, not educate them and make them call-shy.

3 Trying to get too close to a gobbler. Deciding how close you can approach a tom is one of the hardest decisions in turkey hunting. If you stay too far back, your chances of calling the bird in are diminished. But one step too close

***What does it take to** bag this tom? Nothing short of a perfect game. With their keen eyesight and hair-trigger paranoia, gobblers allow hunters few, if any, mistakes. This turkey (right) has the look of a wily customer with no plans of ending up on a dinner table.*

GERALD A. ALMY

GERALD A. ALMY

***To lure a gobbler into** range, hunters have to become handy with a number of different calls. A toot on an owl call (1) or crow call (2) will usually startle a tom into "gobbling" so hunters can locate the bird. Then to lure him in, hunters imitate a receptive female turkey by "yelping," "clucking" or "purring" with a variety of calls such as slate and wood (3), diaphragm (4), slate and glass (5), chalk box (6) and yelper (7).*

and the game is over. Because of this, it's best to err on the side of staying too far away.

In areas with thick cover or rolling hills, you can sometimes approach within 100 yards. In more open terrain, it's better to stay 200 yards or so away to avoid any chance of being seen by the gobbler. Turkeys have incredible eyesight. If they detect the slightest suspicious movement, they will not come in to call no matter how good it sounds.

4 Hiding too well. Because turkeys have such keen vision, many beginning hunters feel like they should hide in brush or a blowdown. This is usually a mistake, because the cover prevents the hunter from seeing the bird unless the tom approaches from directly in front. Also, it makes movement difficult if the tom comes in from the side or behind.

A better approach is to wear total camouflage, remain still and sit with your back against a large tree with a girth as wide as or wider than your body. This will hide your silhouette, and the back support is helpful if it takes a long time to call the bird in. Also, prop your gun barrel over your knee—you'll be surprisingly comfortable, yet able to see all around and move slightly if a bird arrives from an unexpected direction.

5 Calling too much. An expert turkey hunter can call quite frequently and still lure birds in. But for the average hunter with modest calling skills, this is definitely not the best approach. The more you sound off, the more chances you're going to make a bad call. And often you'll make the gobbler feel that if the hen is *that* eager, all he has to do is wait until the talkative female comes to him.

When a turkey is still on the roost, it's particularly bad to call too often. Call once or twice, then wait until he flies down before giving the tom more hen talk. Once the gobbler starts to come in, there's usually little need to call more. The tom knows where you are at and the less you call, the more likely he'll come in—either sneaking or marching boldly through the woods in full strut. If the quarry starts to veer away or hangs up out of range, then it's time to try a few more calls.

6 Using the same call all the time. The best turkey hunters are very versatile with their calls. One minute they may use a diaphragm, the next minute a box. The next time they stop to call, they may pull out a glass or slate.

More than once, I've seen birds ignore one type of call, then come charging in when I switched to another. If you tend to hunt the same areas often, it's possible the birds will come to recognize your calls and know they're not the real thing. Learn at least two or three calls, and carry an assortment of diaphragms, because one day the toms may want a clear call, the next day a raspy call. Or one bird may like one type, while the next one over the ridge prefers a different sound. Also remember to vary the cadence and sequence of your calls.

7 Using the wrong gun or load. Turkeys are strong birds and can't be harvested consistently without the right gun and load. A 20-gauge is effective up to about 30 yards. Beyond that, it is a questionable choice. The best gun for most hunters is a 12-gauge with 3- or 3½-inch chamber, shooting No. 4 to No. 6 magnum loads of copper-plated lead shot. Ten-gauges are fine, but they're heavier than most hunters want to carry and aren't really necessary. A full or extra-full choke is best for this sport, since you'll be shooting at a stationary target and aiming at the head and neck only. A camouflage or dull matte finish is a good idea, and a sling comes in handy for walking between spots and back out to the vehicle after the hunt. Once you've settled on a gun, shoot several varieties of shotgun shells at wide targets (like cardboard) that are placed in a safe location. This will allow you to determine the shot size and brand of shell that delivers the tightest, most consistent pattern.

8 **Not being ready when a gobbler comes in.** I've made this extremely frustrating mistake more than once. To go through all the effort of getting up before dawn, finding a gobbling turkey and setting up just right so it comes in to your calls and then not being ready when the bird appears, is one of the most maddening mistakes you can make.

When you set up and hear a tom respond, make sure your knees are up and the gun barrel is resting across the left knee (if you're right handed). Sit so you are facing slightly to the right of where you expect the tom to come. This way you can move easily to the left or a short distance to the right if the bird isn't exactly where you figured it would be.

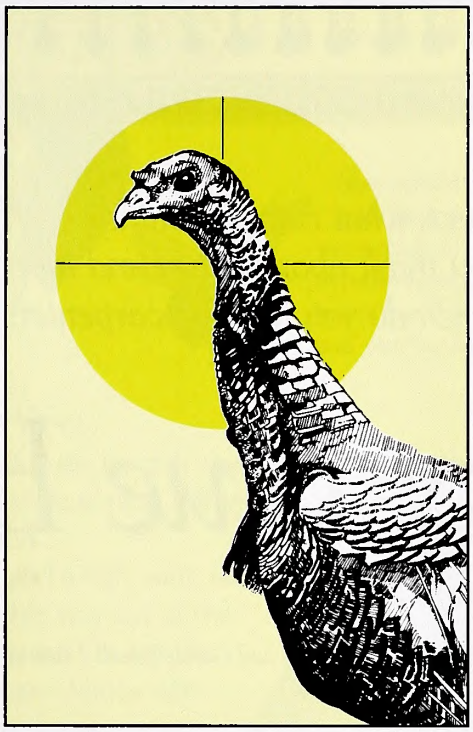
When a turkey begins to approach within range, lean down into the gun and have it pointed in the direction the tom is coming from. This way you'll have to make only a slight adjustment, if any, to be aiming correctly when the bird appears. Make that final movement only when the bird's head goes behind a tree.

9 **Shooting through brush.** If you call a turkey into shotgun range and the only thing between you and the tom is scattered brush, it may be tempting to try the shot. Be patient, though, and pass up such opportunities until the bird moves into the clear. Even a thin screen of branches or tiny saplings can disrupt a pattern and result in a miss or a wounded bird that flies or runs away unrecovered. Chances are with a bit more calling or just by waiting, you'll have a clear line of fire to harvest the tom cleanly.

10 **Giving up too easily.** No one ever said spring turkey hunting was a cinch. If you want a quarry that's almost guaranteed to provide success, seek out squirrels, rabbits or doves. You'll always have at least a slight bulge in the game pouch when pursuing those species. But a turkey hunter has to be willing to accept that more mornings than not, he or she will come home empty-handed.

Keep trying, learn from your mistakes and attempt to do better the next time in locating birds, setting up and calling. If one position doesn't work, move laterally, go above the turkey or circle around to where it came from and try calling again. Sometimes moving away works best, since the turkey thinks the hen is losing interest and leaving.

Be persistent, avoid as many mistakes as you can and sooner or later you'll bag one of these monarchs of the woodlands. When you achieve that goal, the preseason scouting, lost sleep, calling practice, long hikes and days of effort will all seem worthwhile. ⊠



***When a turkey** comes into range, hunters should aim at the head or neck. The best hardware is a 12-gauge shotgun with a 3- or 3 ½-inch chamber, shooting No. 4 to No. 6 magnum loads of copper-plated lead shot. A hunter (below) checks out the spurs on a nice-sized gobbler he bagged.*

GERALD A. ALMY

When you think of bees, what comes to mind?
Do you think about honey and hives?
Or do you think of carpenters, miners and masons?

Busy Blue Bees

written by Logan Williams and Consie Powell / illustrated by Consie Powell

SOLITARY BEES

Of the approximately 20,000 species of bees, more than 85 percent are **solitary**. These are bees that do not live in hives or produce honey, although they do pollinate many plants in the process of collecting pollen and nectar. Each female solitary bee does all the tasks necessary to raise offspring without the help of any other bees. Some of these solitary **native** bees include carpenter bees (which nest in tunnels of wood) mining bees (which burrow in the ground) and mason bees (which build nests from mud or clay). Let's take a closer look at one kind of mason bee.

MEET THE BLUE ORCHARD BEE

The blue orchard mason bee (*Osmia lignaria*) is native to the continental United States and Canada, and is common in North Carolina. Like all mason bees, it collects mud to construct nests for its offspring in hollow twigs, abandoned insect holes or other long narrow cavities. It is active for only a short time in the spring: it mates, feeds on nectar and pollen, builds a nest, lays eggs and then dies. But that active period coincides with the early spring flowering of many plants, so in the process of collecting nectar and pollen for its young, the blue orchard bee also pollinates many wild and domestic fruit trees.

Blue orchard mason bees are about the same size as honey bees, but they are a dark, metallic blue. Because they are very docile, it is easy to observe them up close.

Mason bees will not excavate a nesting hole themselves. They depend on finding pre-existing holes.

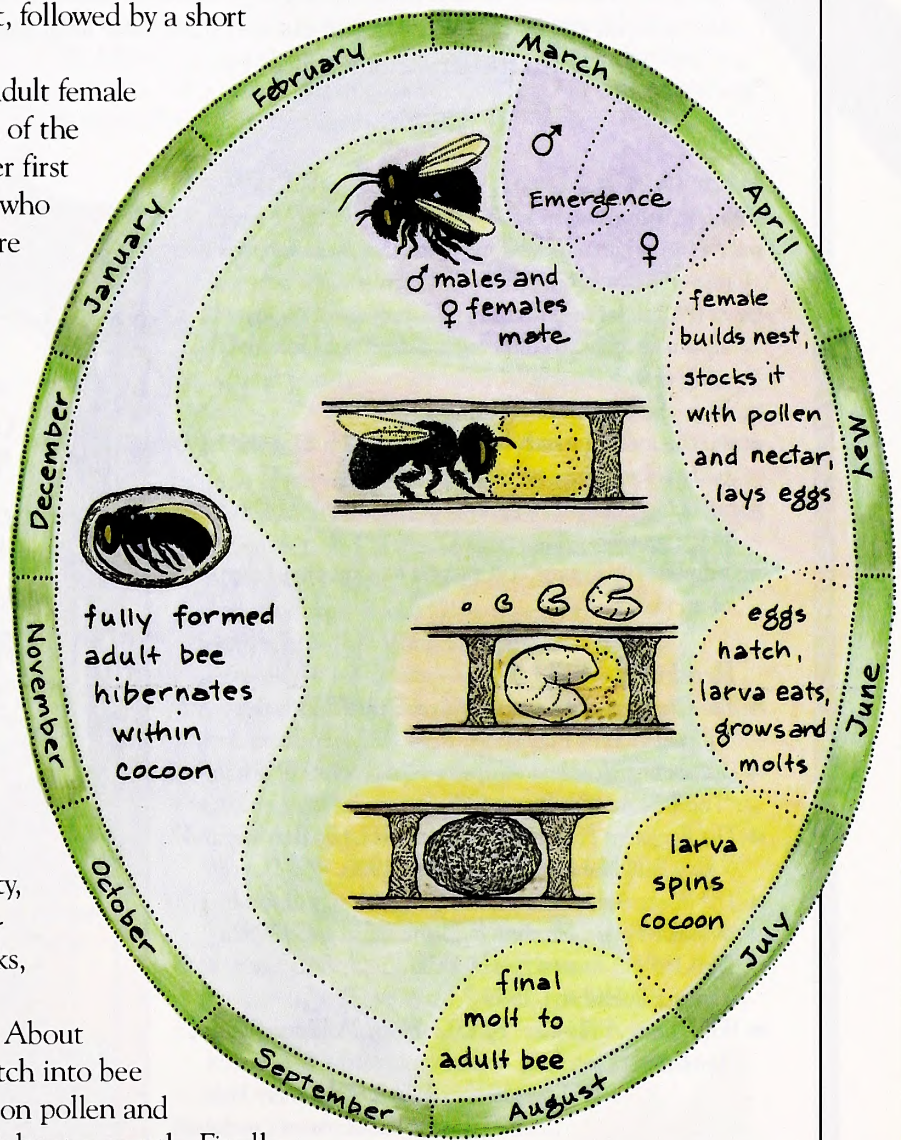
Blue orchard mason bees are very efficient pollinators of early fruits and nuts. They are very hairy and carry pollen on special stiff hairs on the abdomen called scopa, rather than in pollen baskets on the legs. As the bees flit energetically from tree to tree, they drag their abdomens over every flower they visit, ensuring high rates of pollination.

AN ORCHARD BEE'S YEAR

A blue orchard bee's life lasts for only one year. It starts with a long inactive period inside a mud nest, followed by a short active reproductive period.

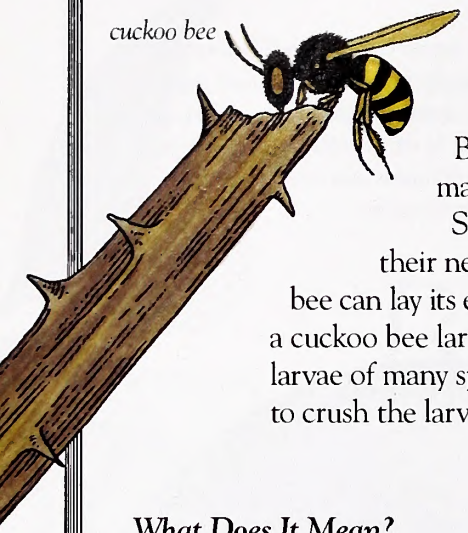
It's the first of April, and a fully adult female blue orchard bee chews her way out of the mud nest where she was born. On her first day of flight, she's ready to mate. Males, who emerged a few days earlier than females, are waiting and ready. Once a pair of bees have mated, the male's job is over and he dies, but the female's work has just begun.

First, she locates a suitable nesting cavity. It might be a hollow blackberry cane, a skinny hole in a garden retaining wall, or even a nesting block put out for her by an interested bee-loving human. Next, she collects mud and starts construction, one by one, of a series of cells inside the nest cavity. In each cell, she places a ball of pollen and wets it with nectar. Once the pollen is completely saturated, she lays a single egg and uses nectar to glue the egg to the pollen ball. Finally, she seals the cell with mud, then starts construction of the next cell. Back and forth she flies, collecting mud and pollen and nectar. She builds five to 10 cells in a nest cavity, then moves to another cavity and starts again. Egg-laying activities continue for about four to six weeks, then the adult bees die.



Blue orchard bee life continues privately now. About six or seven days after they are laid, the eggs hatch into bee **larvae**. Sealed inside a mud cell, a larva feeds on pollen and grows, **molting** four times during a period of about a month. Finally, the larva spins a cocoon within the cell, changes to a **pupa**, undergoes its final molt into an adult bee and overwinters in this dormant stage. Come spring, adult bees emerge from the cocoons, chew out of their mud cells and the cycle starts once again.

Bees and flowers are shown approximately twice their actual size.


cuckoo bee

BUSY, BUT NOT BUILDING ITS OWN NEST

Mason, carpenter and mining bees all build their own nests. But cuckoo bees are **parasites** on other solitary bees. They do not make their own nests, but lay their eggs in the nests of other bees. Solitary bees spend a total of several hours each day away from their nests foraging for pollen and nectar. During this time, a cuckoo bee can lay its eggs in the unprotected nest of another bee. Once it hatches, a cuckoo bee larva is equiped to claim its place in the host bee's nest: the larvae of many species of cuckoo bees have long **mandibles** that they use to crush the larvae of the host bee.

What Does It Mean?

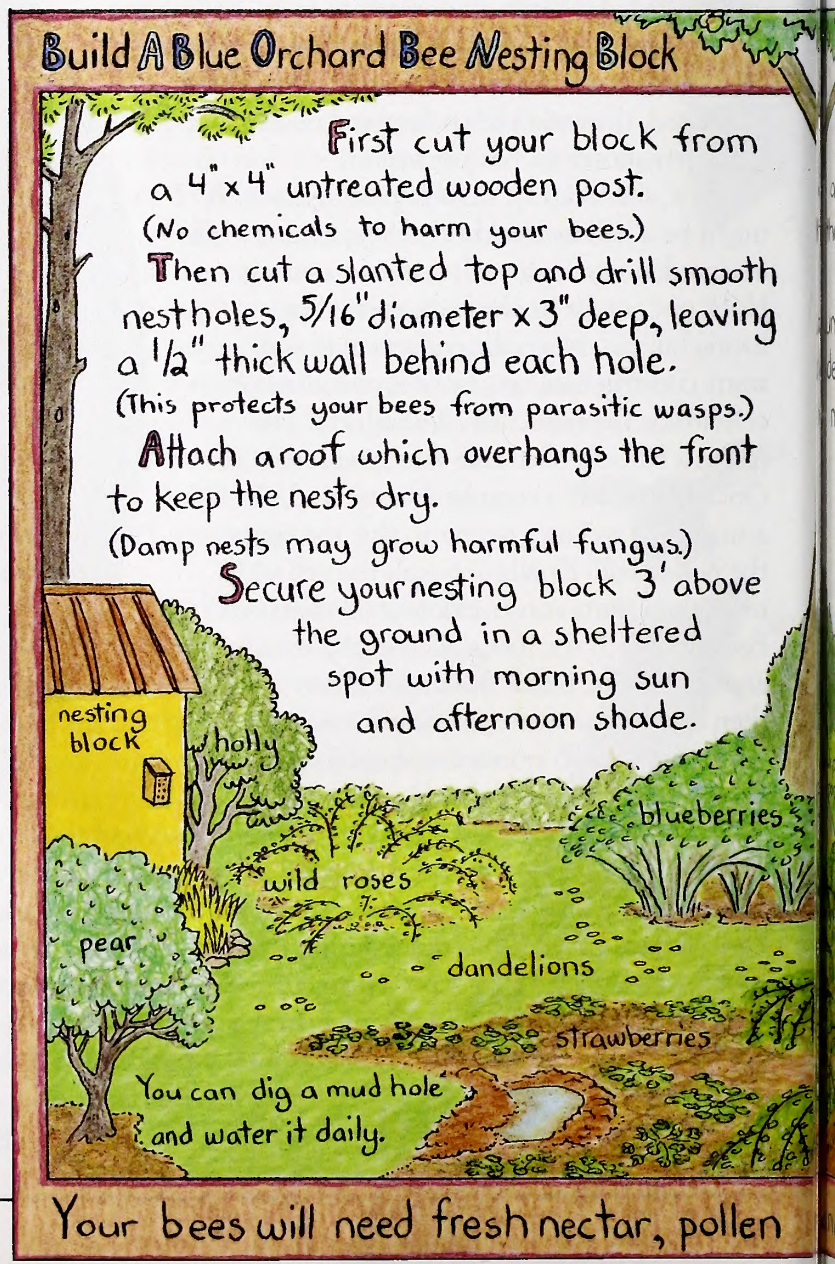
solitary: living alone
native: an original inhabitant of an area, as compared to one which was brought into the area
larva (plural: larvae): the wormlike young of an insect after it hatches from the egg; it does not look like the adult it will become
molt: to shed an outer covering
pupa: the insect growth stage during which time the larva body reforms into an adult
parasite: an organism that lives at the expense of another host organism
mandibles: the jaws or cutting and tearing mouthparts of an insect

Read and Find Out

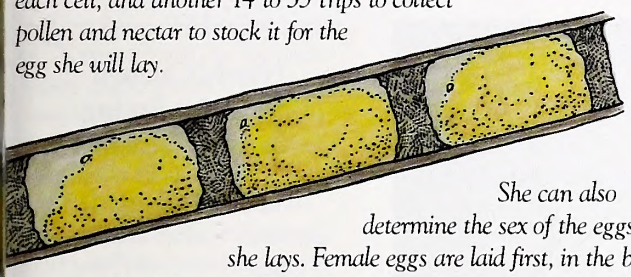
- *The Clover and the Bee* by Anne Ophelia Dowden, HarperCollins Publishers, 1990.
- *Discovering Bees and Wasps* by Christopher O'Toole, The Bookwright Press, 1986.
- *The Forgotten Pollinators* by Stephen L. Buchmann and Gary Paul Nabhan, Island Press, 1996.
- *The Insect Almanac: A Year-Round Activity Guide* by Monica Russo, Sterling Publishing Co. Inc., 1992.
- *The Orchard Mason Bee* by Brian L. Griffin, Knox Cellars Publishing, 1993.
- *What Does A Bee See?* by D.C. Ipsen, Addison-Wesley Publishing Co., 1971.
- *National Audubon Society Field Guide to North American Insects and Spiders* by Lorus and Margery Milne, Alfred A. Knopf, 1995.

mining bee

Editing and design by Consie Powell. Art puzzle by Anne Marshall Runyon.



A female mason bee makes eight to 12 mud-collecting trips to build each cell, and another 14 to 35 trips to collect pollen and nectar to stock it for the egg she will lay.



She can also determine the sex of the eggs she lays. Female eggs are laid first, in the back cells of the nest hole, and males are laid in the front of the hole. This strategy guarantees that males emerge before females, and that female larvae are less likely to be attacked by parasitic bees.

Get Outside

Attract blue mason bees or other wild native bees to your yard: Make a nesting block for mason bees, following the directions in the art puzzle on this page. (Make sure you use *untreated* wood). Mason bees will also nest in other cavities as described in *The Orchard Mason Bee* and *Discovering Bees and Wasps*, listed in the "Read and Find Out" section on page 30.

Visit the Museum: Stop by the Museum's Bee Exploration Station, located on the mezzanine, on Tuesday mornings in April, 10 a.m. - noon to discover what these buzzing bugs eat, where they live, and how they fly. Visit the Discovery Room's real beehive, buzzing with life: Monday-Friday, 1-3 p.m.; Saturday, 12:30-4 p.m.; Sunday, 1-4:30 p.m. All programs are free. North Carolina Museum of Natural Sciences. For more information, call (919) 733-7450.

It's WILD!

Project WILD activities for teachers and students that correlate to this topic include:

Interview a Spider: teaches students that wildlife comes in all sizes, forms, colors and adaptations.

Who Lives Here?: teaches students to identify some native and non-native animal inhabitants of their area.

Get WILD

June 13-18 – *Fur, Fish 'n Game Rendevous Camp*, outdoor education camp for youth ages 12-15 at the Millstone 4-H Center near Ellerbe. First 85 applicants only; $250. Contact local county Cooperative Extension Service for registration forms or call (919) 515-3244.

Advanced WILD Workshops:

April 17-18 – *Migratory Songbirds*, Cool Springs Environmental Education Center near New Bern. Call Mike Campbell, (252) 514-6663.

April 24-25 – *Migratory Songbirds*, Howell Woods Environmental Education Center, Smithfield. Call Katrina McDougald, (919) 751-2040.

May 22-23 – *Aquatic Ecosystems*, Fayetteville. Call Katrina McDougald, (919) 751-2040.

June 10-11 – *Migratory Songbirds*, Morrow Mountain State Park, Albermarle. Call Mel Porter, (704) 982-1523.

June 16-17 – *Endangered Species*, Fairview Elementary School, Monroe, Call Mel Porter, (704) 982-1523.

June 21-23 – *Mountain Stream Ecology*, Pisgah Center for Wildlife Education, Brevard. Call Program Coodinator, (828) 877-4423.

July 28-29 – *Bats*, Pisgah Center for Wildlife Education, Brevard. Call Program Coordinator, (828) 877-4423.

carpenter bee

Hunters Look Forward to Record Acreage for Spring Wild Turkey Season

MELISSA McGAW

Mike Seamster (left), *wild turkey project leader for the N.C. Wildlife Resources Commission, and Dr. James E. Kennamer, vice president of conservation for the National Wild Turkey Federation (NWTF), watch a wild turkey launch into the wild. The release commemorated the start of the Turkey Federation's national convention held in Charlotte in February. Seven gobblers and 11 hens were released near Asheboro.*

The N.C. Wildlife Resources Commission has approved turkey hunting in a record 62 new areas in 35 counties this year.

Mike Seamster, the Wildlife Commission's wild turkey project leader, said more acreage will be available for the 1999 spring gobbler season than at any other time in the state's 30-year turkey restoration effort.

"Last year, we opened 38 former restoration areas," Seamster said. "This year in these 35 counties, we will be opening 62 new areas."

The ability of an area to sustain turkey hunting is determined through the efforts of volunteers who document wild turkey sightings. Property owners near turkey restoration areas are asked to participate in summer brood surveys by reporting any offspring seen accompanying a hen turkey. Also, wildlife enforcement officers, forestry personnel and others are asked to record the number of turkeys encountered annually. When the number of sightings becomes consistent in a particular area, Seamster then recommends to the Wildlife Resources Commission that the section be approved for a spring season.

Because only male gobblers can be harvested, newly opened turkey hunting areas have a good chance of sustaining a turkey population. "Harvesting one gobbler isn't going to dramatically affect breeding, because another gobbler will breed with multiple hens and fill in the void. Turkeys don't pair for life like some species," Seamster said.

The future is also looking bright for many areas still closed to turkey hunting. A dry 1998 spring and early summer provided for a very strong hatch of poults (juvenile birds) which should pay dividends later. "We had a real good hatch this past year," Seamster said. "We consider good reproduction to be anything above three poults per hen, and we had about 3.5 poults per hen in 1998, so we had a good year."

The Wildlife Commission's long-term goals are to have spring and fall gobbler seasons in every county of the state. Biologists have been able to resurrect the state's turkey population from a mere 2,000 birds in 1970 to about 100,000 birds today. During the past three decades, well over 5,000 turkeys have been released on more than 325 restoration sites across the state. Thanks to the dedication of wildlife biologists and the support of sportsmen, wild turkeys now exist in 99 of the state's 100 counties.

—Chris Powell

Newly Opened Areas for Spring Gobbler Season

The counties containing newly opened areas for spring gobbler season are: Alamance, Beaufort, Bertie, Bladen, Brunswick, Cabarrus, Chatham, Columbus, Cleveland, Craven, Durham, Edgecombe, Franklin, Granville, Guilford, Halifax, Hoke, Jones, Johnston, Lee, Lincoln, Martin, Moore, Nash, Northampton, Pamlico, Pender, Randolph, Robeson, Rowan, Sampson, Vance, Warren, Wake and Wayne.

For a complete listing of all legal turkey-hunting areas, see page 37 of the *1998-99 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest.*

Edited by Chris Powell

Got a Gobbler?

Call 1-800-I-GOT-ONE to report your turkey harvest.

**All bearded birds harvested during the 1999 turkey season must be reported either through a cooperator agent or via the toll-free telephone reporting system.*

Wildlife Commission Expands Striper Fishing on the Roanoke River

An increased harvest quota should provide Roanoke River anglers with a longer striped bass season this spring. Pete Kornegay, fishery research coordinator for the N. C. Wildlife Resources Commission, said last year's 62,700-pound quota will be increased 10 percent for 1999.

"Every year, we sit down with our catch data for the current year and years past and estimate the number of fish removed from a population," Kornegay said. "We can also estimate how many new, young fish we have coming in every year, so these numbers give us a good idea of safe harvest levels for the coming years."

The striped bass season on the Roanoke River will open March 13 and will be closed when about 69,000 pounds of stripers are caught. Until the season is closed, stripers may be harvested on Wednesdays, Saturdays and Sundays in the Roanoke River Management Area, which includes the Roanoke, Cashie, Eastmost and Middle rivers as well as their tributaries.

As in previous years, anglers can keep three fish per day on the open fishing days, with a minimum size limit of 18 inches. Between the April 1 to May 31 spawning period, no stripers between 22 and 27 inches may be retained on the Roanoke River.

Also, a regulation to protect spawning stripers will remain in effect this year. Only single, barbless hooks can be used from April 1 through June 30 in the waters of the Roanoke River upstream of U.S. 258 at Scotland Neck. This legal requirement can also be met by crimping down the barb of each hook with pliers.

The spring striper season on the Roanoke River will be closed when the quota is met. However, catch-and-release fishing remains a viable option through June. Because so many spawning fish will be caught, it is important that all stripers be handled gently and released as quickly as possible.

"On an average year on the Roanoke River, approximately 200,000 stripers are caught and released from the opening of the season in March until late May," Kornegay said. "The mortality rate for these caught-and-released fish is 6 percent, but it can be much higher if the fish aren't handled properly."

Anglers are encouraged to use barbless, wire hooks rather than stainless steel hooks when fishing for fun. Also, fishermen should avoid touching the fish with dry hands or using a towel for a better grip. If possible, fish should be released while still in the water. For deeply hooked fish, the line should be cut as close to the eye of the hook as possible before releasing the fish. This will allow the hook to dissolve inside the striper.

Following a decade-long recovery effort, the Roanoke River/Albemarle Sound striper population was declared recovered in 1997 by the Atlantic States Marine Fisheries Commission.

And though striper populations are considered healthy, the Wildlife Commission's Division of Inland Fisheries still believes the fishery needs conservation-minded management.

"The problem with our striper fishery now is that it consists of fish mostly 6 years old and younger," Kornegay said. "We'd like to see older fish in the population, which would be beneficial during years when spawning isn't good. Historically, there have been 40- and 50-pound fish in the population, although they have been few in number. There have been records during the Colonial period of 125-pound fish, and 80- and 90-pound fish back then were not uncommon."

—*Chris Powell*

KEN TAYLOR

***Anglers on the Roanoke River** will be able to take home 10 percent more stripers than last year, as a result of a recent decision by the N.C. Wildlife Resources Commission. The striped bass season on the Roanoke will open March 13 and will close when about 69,000 pounds of stripers are caught.*

Field Notes

•Wild Turkey (bearded birds only)	April 10-May 8
•Hatchery Supported Trout Waters	Opens April 3
•Wild Trout Waters	Year-Round
•Delayed Harvest Trout Waters	Catch-and-release through June 4

Information on bag limits and other regulations may be found in the *1998-99 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest*. For a copy, check with license agents or contact the N.C. Wildlife Resources Commission at 1-800-675-0263.

Outdoor Tips

Shallow Hangups— Every fisherman gets lures hung on structure occasionally. But when our lure or bait hook snags on a limb or stump beneath the surface, yanking hard seldom works. In fact, that's a good way to break a rod or set the hook even more firmly. For underwater snags not too deep, the best method is to position the boat directly over the structure, then poke your rod tip down into the water while reeling up the slack until the rod reaches the lure. A little jiggling or a push will usually free the line.

—Jim Dean, Raleigh

Editor's note: *Got a tip or suggestion you'd like to share? Write Chris Powell at 512 N. Salisbury St., Raleigh, N.C. 27604; Fax: (919) 715-2381; E-mail: (powell.chris @coned.wildlife.state.nc.us)*

Registration Opens for Fur, Fish 'n Game Camps

Registration is now open for boys and girls, ages 12-15, who wish to participate in the 1999 Fur, Fish 'n Game Rendezvous camps. The registration fee is $250 per camper, and registration forms can be obtained by calling (919) 515-9606 or contacting your local county Cooperative Extension Service Center.

Held June 13-18, the regular and advanced camps will each be open to the first 30 respondents. The camps will be conducted at the Millstone 4-H Center, located in the Richmond County portion of the Sandhills Game Land.

Accredited by the American Camping Association, the Millstone 4-H Center provides trained camp counselors, with class instruction handled by a variety of professional natural resource managers and educators.

First-time participants will study wildlife and aquatic biology, earn a Hunter Education Certification, learn about firearm safety and be involved in numerous recreational activities.

Children who've already participated in a Fur, Fish 'n Game camp will qualify for the Outdoor Resources Career Camp (advanced camp). Advanced campers will learn about prescribed burning, wildlife surveys, estimating timber value, dendrology, animal damage control and endangered species management.

The camp is sponsored by the N.C. Cooperative Extension Service, N.C. Wildlife Federation, N.C. Wildlife Resources Commission, N.C. Bow Hunters Association and the Wake County Wildlife Club.

—Courtesy of the N.C. State University Forestry Extension Department

North Carolina Outdoor Calendar of Events

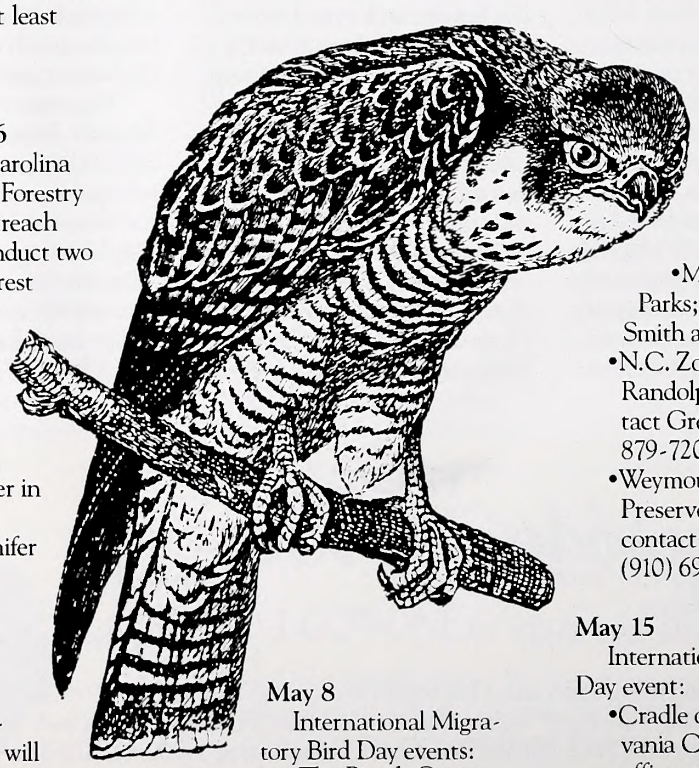
On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

April 20, May 6

The North Carolina State University Forestry Educational Outreach program will conduct two workshops on forest management for migratory and resident birds at the Cool Springs Environmental Education Center in New Bern. To register, call Jennifer Barnes at (919) 515-3184.

May 1-2

The North Carolina Herpetological Society will hold its annual spring meeting at Lake Mattamuskeet Lodge. Anyone interested in reptiles or amphibians is welcome to attend. For more information, call Jeff Beane at (919) 733-7450 Ext. 754.



May 8

International Migratory Bird Day events:

- The Pisgah Center for Wildlife Education, near Brevard; call (828) 877-4423 for more information.
- Blue Jay Point County Park, in Wake County; contact Amber Parker at (919) 870-4332.
- Howell Woods Environmental Learning Center, in Johnston County; contact James Sasser at (919) 938-0115.
- Mecklenburg County Parks; contact Marek Smith at (704) 875-1391.
- N.C. Zoological Park, Randolph County; contact Greg Holiday at (336) 879-7201.
- Weymouth Woods Nature Preserve, Moore County; contact Scott Hartley at (910) 692-2167.

May 15

International Migratory Bird Day event:

- Cradle of Forestry, Transylvania County; contact the office at (828) 877-3130.

From Russia with Love for Wildlife

As part of an international exchange program, a group of North Carolina wildlife professionals recently hosted three Russian foresters from Smolensk Lakelands National Park, located in western Russia.

Smolensk Park foresters Alexandre Mirotchnik, Serguei Iaroslavtsev and Serguei Prokopiev spent two weeks in North Carolina as guests of the North Carolina chapter of The Wildlife Society (NCTWS). The Russians' trip was sponsored by the NCTWS, which obtained a grant from the Camp Younts Foundation.

NCTWS members Carl Betsill and Anne Hice, who work for the N.C. Wildlife Resources Commission, instructed the visitors on various wildlife issues including fire ecology, beaver pond and ecology management, and the use of canines in wildlife law enforcement.

"With moose and timber wolves the premier wildlife species in Smolensk Park, our white-tailed deer and turkey management programs were quite a switch for them," Betsill said. "But we have a lot more in common with our Russian colleagues than I had thought at first."

In addition, the Russian visitors were treated to a New Year's Day squirrel hunt with NCTWS member Terry Sharpe, a small game biologist with the Wildlife Commission. Though squirrels are a game animal in the United States; they are not a food source in Russia.

"We don't think squirrel dumplings are exactly considered proper table fare in Russia," Sharpe joked.

The exchange program started in 1994 when Betsill and Hice spent two weeks at the newly created Smolensk Park, training rangers and teachers. The park is a 350,000-acre island of forest located at the head of the watersheds feeding the Baltic, Black and Caspian seas.

"NCTWS plans to continue the exchange programs by maintaining contacts with our Russian counterparts and donating much-needed equipment and supplies," Betsill said. "To date, the chapter has donated computers, plotters, forestry equipment and a water quality test kit. It is a very rewarding program that benefits us as much as the Russians."

—Courtesy of The Wildlife Society, North Carolina chapter

KEN TAYLOR

***Hugh Frazer (left) of the** N.C. Division of Forest Resources demonstrates to a group of Russians and Americans the benefits of controlled burning at Bladen Lakes State Forest. The Russian foresters recently visited North Carolina as part of an international exchange program.*

On Patrol

Editor's note: *While most North Carolina sportsmen are law-abiding, a few are not. Listed below is a report of one wildlife violation that exemplifies the humorous, and at times bizarre, situations our wildlife enforcement officers encounter while on patrol.*

While checking bass fishermen on Falls Lake, officers have been encountering several size and slot-limit violations. One fisherman told the officers that he was going to release the illegal fish in his livewell as soon as he found someone to take his picture with it. The obliging officers borrowed the man's camera and snapped a picture of him holding the fish as well as his pink citation form. The fish was released unharmed.

Northwest River Game Land Acreage to Expand

One of the N.C. Wildlife Resources Commission's premier game lands will grow by 63 acres, as a result of a recent donation to The Nature Conservancy.

The Nature Conservancy received the portion of the Nellie Bell Ponds natural area from Highland Properties Inc. The property will be donated to the Wildlife Commission as an addition to the Northwest River Game Land. "The donation should be official by this summer," said Wib Owen, section manager for the Wildlife Commission.

The Nellie Bell Ponds natural area is part of a corridor of forested and freshwater wetlands along the Northwest River in northern Currituck County. The Highland Properties tract is primarily composed of a swamp forest inhabited by numerous wildlife species such as black bears and neotropical migratory songbirds.

"Protecting the Highland Properties tract is an important part of our efforts to establish a wetland corridor along the Northwest River," said J. Merrill Lynch, assistant director for protection for The Nature Conservancy's North Carolina chapter.

The freshwater marshes in the surrounding area provide important habitat for waterfowl such as black ducks and snow geese, as well as a high diversity of plant species that include the rare twig-rush and winged seedbox. In addition to hunting, the marshes will be ideal for kayaking or boating.

—Courtesy of The Nature Conservancy

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through January 1999

Principal Balance
$27,454,856.85

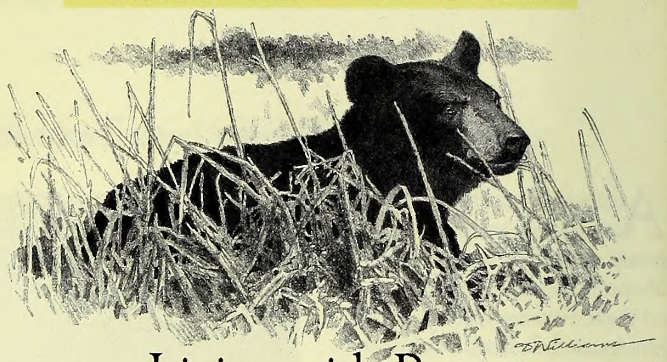
Interest Earned
$27,149,137.94

Total Receipts
$54,603,994.79

Interest Used
$15,250,446.04

Fund Balance
$39,353,548.75

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.



Living with Bears

by Rodney Foushee

The growth in North Carolina's black bear population is one of the great success stories for wildlife management in the state. Under the management of the N.C. Wildlife Resources Commission, bear numbers have surged to about 9,000 over the past 30 years. Many of these bears have expanded into Mountain and Coastal Plain counties where they haven't been seen since the turn of the century. But with the state's human population skyrocketing, encounters between bears and people are becoming all too common.

To help prevent or reduce problems with black bears, the Wildlife Commission has produced a 12-page booklet, *Living in Black Bear Country*. This timely guide provides detailed steps for dealing with bears *before* they become a serious problem. The key is to discourage bears from interacting with humans and keep them wild.

Though they are powerful animals and can exceed 600 pounds, black bears are naturally shy and normally avoid contact with humans. However, when wild food is scarce or they are traveling to a new territory, bears may visit populated areas.

When bears emerge from their winter sleep in early spring, they are very hungry. They will feed on almost anything including garbage, birdseed, pet food or grease on a backyard grill. Keep these potential foods secure and stored indoors, if possible, through early July if you notice bears in your area. Never feed bears, even if they look hungry or tame. Bears that get used to human foods are much more dangerous than wild bears, and sometimes have to be killed.

During summer, male bears will sometimes migrate through populated areas looking for mates or new territory. They will not stay long unless they are fed. If you see a bear, don't panic. Enjoy this rare moment from a distance. If the bear seems too close, back away slowly and make lots of noise. The bear should run away.

Besides preventing problems at home, *Living in Black Bear Country* also covers methods for using electric fencing, noise-making devices and hounds to discourage bears from beehives, orchards, crops and livestock. Large landowners can also reduce local bear numbers by allowing legal bear hunting on their property.

To get a free copy of the bear booklet, write the Wildlife Commission's Division of Wildlife Management, 512 N. Salisbury St., Raleigh, N.C. 27604-1108. Or call (919) 733-7291.

N.C. WILD STORE

NEW!

Introducing the second poster in our "Sporting Heritage" series...

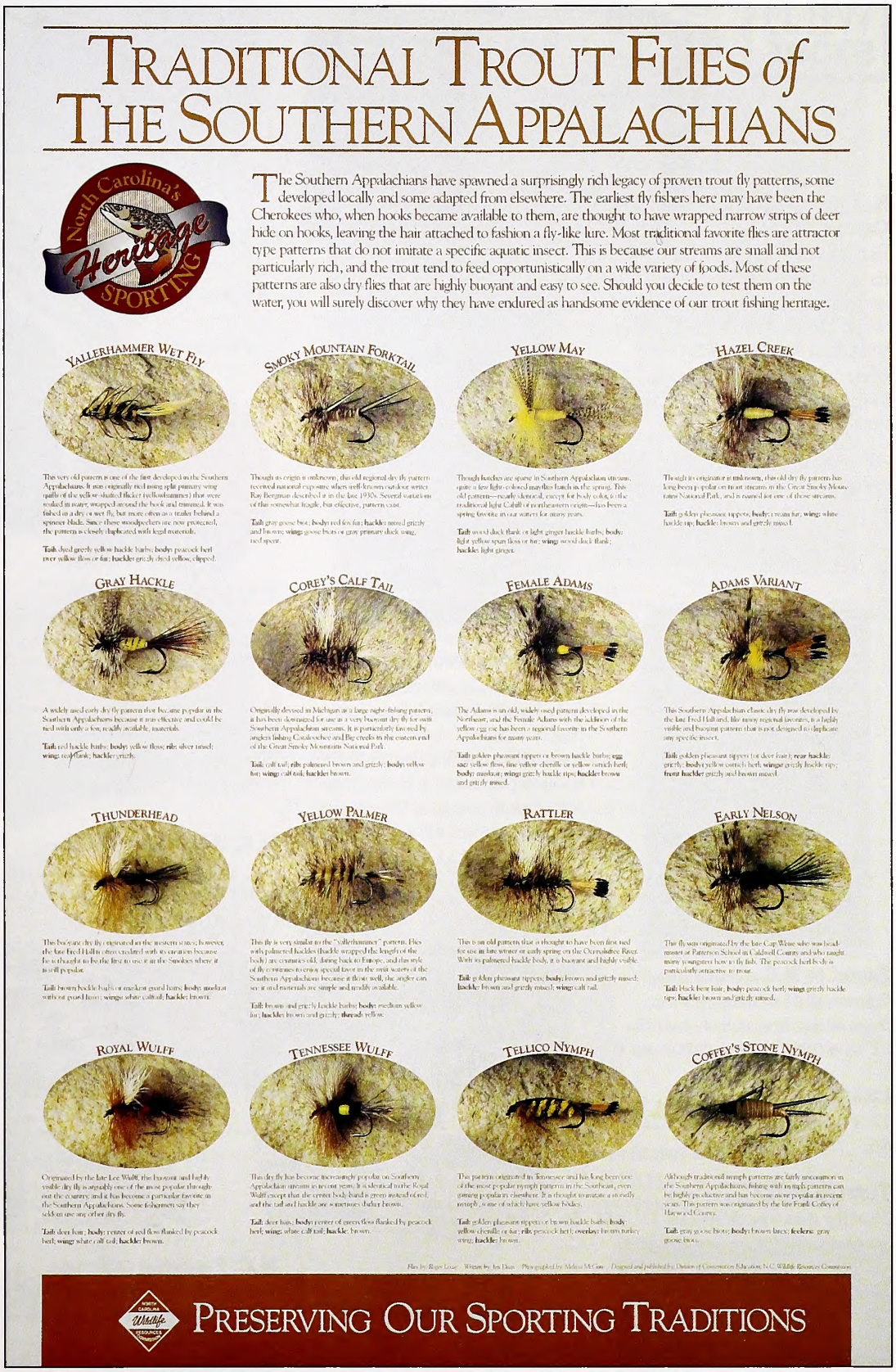
TRADITIONAL TROUT FLIES OF THE SOUTHERN APPALACHIANS

Sixteen traditional trout flies are presented in stunning color detail. This high-quality, framable poster is destined to become a showpiece and reference for trout anglers across North Carolina and beyond. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. $10. ITEM CODE P13

★★★★★★★★★★★★★★

COMING SOON!

Look for the second poster in our colorful "Frogs of North Carolina" series. (See page 38 for the first in the series.)



More terrific items ☛

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50.
ITEM CODE **M9**

Also available as a boxed set. $30.
ITEM CODE **M10**

Waterfowl Decoys of N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.
ITEM CODE **P12**

Frogs of N.C. (The Hylids)

Presents all 15 of the state's tree frogs, cricket frogs and chorus frogs. 22" x 34". $6. ITEM CODE **P11**

Lizards of N.C.

12 of the state's lizard species. 22" x 34". $6. ITEM CODE **P3**

Turtles of N.C.

21 of the state's turtle species. 22" x 34". $6.
ITEM CODE **P4**

Snakes of N.C. (Livebearers)

17 of the state's snake species. 22" x 34". $6. ITEM CODE **P5**

Snakes of N.C. (Egglayers)

19 of the state's snake species. 22" x 34". $6. ITEM CODE **P8**

Set of 4 Posters

Save $6 by purchasing all four reptile posters. $18.
ITEM CODE **P10**

Pisgah Center for Wildlife Education T-shirt

"Mountain streams, where water and life begin" is printed on the back of a 100% cotton, natural color T-shirt with colorful Pisgah Center logo. Located near Brevard in Transylvania County, the Pisgah Center should be included in your next visit to the N.C. mountains. $14.50.

ITEM CODES:
A8MED (medium)
A8LRG (large)
A8XLG (extra large)
A8XXL (extra extra large)

Wildlife in N.C. Caps

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE **A3**

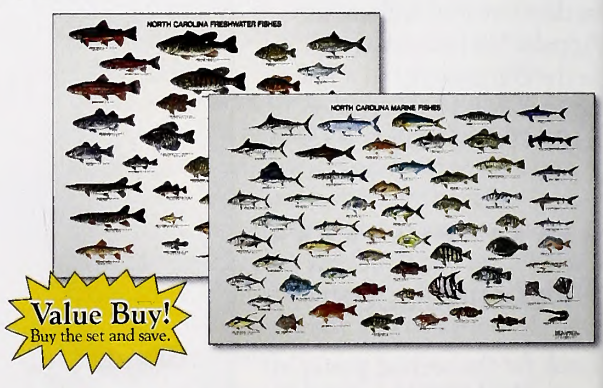
Blaze orange and camouflage hats embroidered with magazine logo and buck deer silhouette. **$16.50 each.**

Blaze orange with brown waxcloth bill. ITEM CODE **A7**

Advantage® Camouflage with tan suede bill. ITEM CODE **A6**

N.C. WILD Cap (not shown)

N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50.
ITEM CODE **A1**



N.C. Freshwater Fishes

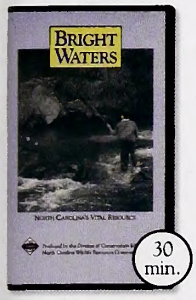
Find your favorite fish with this color poster showing 36 of the state's freshwater fishes. 28" x 22½". $6. ITEM CODE **P6**

N.C. Marine Fishes

All the colors of the sea can be found on this poster of 60 marine fishes. 35" x 22½". $6. ITEM CODE **P7**

N.C. Freshwater And Marine Fishes

Save $2 when you buy both posters as a set. $10. ITEM CODE **P9**

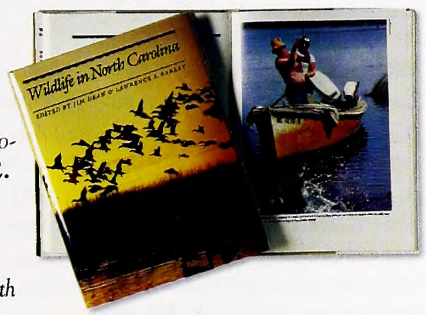


Bright Waters Video
Fishing and fisheries management in N.C.'s freshwaters. **$20.** ITEM CODE **N7**

Protecting Our Wildlife Heritage Video
Offers tips for landowners on managing small game. **$20.** ITEM CODE **N8**

Wildlife Babies Video
Enjoy antics of young wildlife in this 1965 classic . **$20.** ITEM CODE **N9**

Dogs that Point, Fish that Bite
Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. **$19.95.** ITEM CODE **M8**

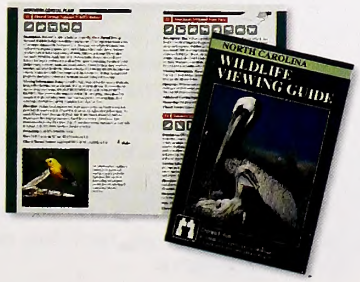


Wildlife in North Carolina Book
The best of *Wildlife in North Carolina* magazine. Hardbound. **$12.** ITEM CODE **M3**

Magazine Binder
Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. **$10.** ITEM CODE **M2**

Bird Houses & Feeders: How to Build and Enjoy Them
An eight-page illustrated guide to building bird houses and feeders. **$2.** ITEM CODE **M6**

Scouting Correlations
Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each **$3.**
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**



North Carolina Wildlife Viewing Guide
From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. **$5.95.** ITEM CODE **N6**

North Carolina WILD Places Map
Artist's Proof. **$40.** ITEM CODE **E2**
Limited Edition. **$25.** ITEM CODE **E3**
Poster. **$6.** ITEM CODE **E4**

North Carolina WILD Places Posters
(Set of 3): Posters of "Old Field" and "Mountain Cove Forest" from *North Carolina WILD Places: A Closer Look.* 19½" x 16". Shipped folded with poster version of WILD Places Map. **$8.** ITEM CODE **E5**

WILD Places Book and Posters
Buy the *North Carolina WILD Places* book and all three posters and save! (Items E1 and E5) **$16.**
ITEM CODE **E6**

Value Buy! Buy the set and save.

North Carolina WILD Places: A Closer Look
Easy-to-read text and Anne Marshall Runyon's delightful illustrations make wildlife habitats come alive in this 82-page book. Discusses 13 habitats across the state. **$10.** ITEM CODE **E1**

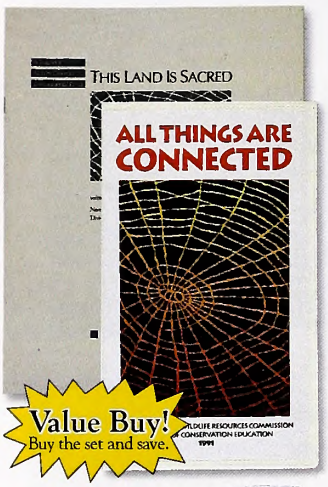
North Carolina WILD Places Teacher's Guide
For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats.
$6. ITEM CODE **E7**

North Carolina WILD Journal
Handy calendar notes on wildlife behavior through the year, with room for personal observations. Supplements N.C. WILD Education Sites workshop. **$6.**
ITEM CODE **E8**

More terrific items

N.C. WILD STORE

GARDENS FOR BUTTERFLIES
Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. $2. ITEM CODE **M5**



ALL THINGS ARE CONNECTED & THIS LAND IS SACRED
Video and Teacher's Guide package. $22. ITEM CODE **W3**

ALL THINGS ARE CONNECTED
Stirring 12-minute video adaptation of Chief Seattle's speech introduces environmental ethics. $20.
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THIS LAND IS SACRED (TEACHER'S GUIDE)
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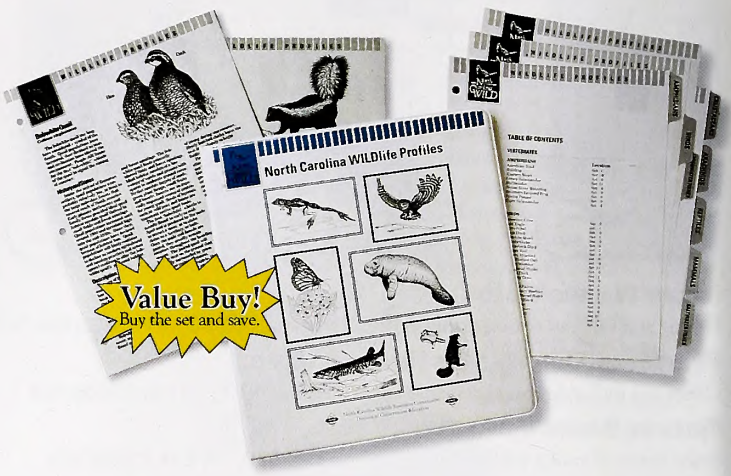

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Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.
ITEM CODE **W7**

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster. ITEM CODE **W8**

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat. ITEM CODE **W9**

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.
ITEM CODE **W10**

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad. ITEM CODE **W11**

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish. ITEM CODE **W12**

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet. ITEM CODE **W13**

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet. ITEM CODE **W14**

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.
ITEM CODE **W15**

WILDLIFE COMMISSION

SPOTLIGHT

Playing It Safe on the Water

KEN TAYLOR

With the approach of the summer boating season, officers with the N.C. Wildlife Resources Commission will be busy ensuring safety on the state's lakes, rivers and sounds. With more than 300,000 registered vessels out there, you can do your part to keep North Carolina's waters safe:

⚓ Make sure your personal flotation devices (PFDs) and other required safety equipment are in good, serviceable condition before you leave for that first boating trip of the season.

⚓ Make sure children and non-swimmers wear their life jackets at all times while they are on and around the water. Remember that a life jacket is useless unless it's being worn.

⚓ Avoid alcohol use while boating. Alcohol is a factor in at least 40 percent of fatal boating accidents in North Carolina.

⚓ Operate watercraft in a safe and responsible manner. Be especially familiar with the handling characteristics of your craft.

⚓ Enroll in a boating safety course to freshen up your safe boating skills. Call (919) 733-7191 for more information.

⚓ Always use common sense and caution while on the water. With operator inattention the leading cause of boating accidents, a little common sense can go a long way in preventing mishaps.

photographs by Melissa McGaw

Family Portrait

None of us would want the kind of life this pair of hooded warblers faces for the next several weeks. With a bunch of voracious nestlings clamoring to be fed, Mom and Dad will wear themselves out bringing home the groceries.

Periodicals postage paid at
Hickory, North Carolina

LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
CONOVER, NORTH CAROLINA

45
7: 63/5

WILDLIFE IN NORTH CAROLINA

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Comfort Fish

by Jim Dean ©1999

JIM DEAN

"...few angling pleasures are more pure than anchoring a small boat near a bunch of spawning bluegills on a balmy spring day."

Fishing opportunities are so wonderfully conflicted this time of year. Poor baby, everything is biting. Bass are busting loose, mountain trout are scarfing mayflies, salty species are on the move in the surf and offshore, and rockfish are running in the Roanoke. Shucks, we could be wading a tarpon and bonefish flat in mere hours. Lash us to the mast, mates, the sirens have got us surrounded.

Some fishermen try to do it all, spending every spare moment chasing glamorous, challenging gamefish. It can be exciting, but there's always that nagging suspicion that you've zigged when you should have zagged—that the fishing is momentarily better somewhere that you don't happen to be. Is that why, in angling's prime time, so many of us find room for bluegills?

At first glance, it seems an odd choice if not an outright capitulation. Bluegills are relatively small, ridiculously easy to catch, and the best spots are often in decidedly unexotic farm ponds. So what's the appeal? Some say it's a moon thing, a subtle lunar influence that wedges itself into the psyche, awakening ancient urges. Others claim it's the tug of nostalgia for the first fish we ever caught. I suspect it's at least partly because we can eat only so many high-toned meals before we've got to have a slab of pizza or a bacon-and-egg sandwich. Comfort food. Some of us need bluegills in our piscatorial diet.

For me, few angling pleasures are more pure than anchoring a small boat near a bunch of spawning bluegills on a balmy spring day and catching them on small popping bugs or sinking flies.

This kind of fishing doesn't demand high skills or fancy tackle, but a few tips can improve your success. A fly rod suitable for largemouth bass will certainly work, but heavy tackle is a poor match for bluegills, and tiring to use. In recent years, the trend has been toward fly rods designed for very light 1-, 2- and 3-weight lines. It's fun to catch bluegills on such rods, but you're pretty much restricted to using small dry flies and unweighted sinking flies—those rods simply won't cast larger cork poppers or weighted flies. A bigger problem is that every tiny bluegill in the pond can, and will, eat those small flies so that you wind up catching mostly runts.

A more versatile choice is an 8½- or 9-foot graphite fly rod that balances with at least a 5-weight line (I prefer a 6-weight). Quite simply, you're handicapping yourself to use anything lighter or shorter. Such a rod is more capable of handling a size 8 or 10 cork popper or sinking fly, and larger bluegills (and redear sunfish or shellcrackers) that range from a dozen ounces up to a pound or more have mouths plenty big enough to eagerly gulp these offerings.

You don't need a wide variety of floating bugs when bluegills are striking on the surface. A simple white or chartreuse popping bug with white rubber legs will do the job. Some fishermen like deer hair bugs, and some swear by foam rubber spiders with white legs, but they all work.

Although bluegills are suckers for floating bugs, they often prefer to feed beneath the surface even in very shallow water. That's even more true of shellcrackers. I've found that I usually catch more and bigger fish when I use sinking flies, and I believe you will, too. Over the years, I have experimented with countless patterns in various colors, but it's hard to beat dark colors, especially black. A hard-bodied black ant is a killer for both species. I've also had good luck with a very simple sinking pattern I tie with a black chenille body and white rubber legs on a No. 8 hook. I've found it helpful to weight some of them by wrapping lead wire on the hook before I wrap the chenille for those times when I'm fishing water more than a couple of feet deep, but you can also simply pinch a split shot on the line. These chenille flies aren't available commercially, but you can easily tie them yourself.

Since I seldom fly fish for bluegills and shellcrackers in water more than about 5-feet deep, I stick with a floating line and a tapered leader about 8- to 10-feet long. These panfish aren't leader shy, so I use a 6- or 8-pound test tippet. Besides, it isn't unusual to hook a nice largemouth bass while fishing for bluegills. I once landed a 7-pounder on a size 12 black ant. Yes, t'was fun.

There's nothing very complicated about this kind of fishing but, like fine wine, it yields complex, sensual pleasures and it has a long, satisfying finish. No, wait. That's not the right metaphor for comfort food. How's this? Fly fishing for bluegills is like sitting down to a pile of greasy cheeseburgers, large fries and a chocolate shake.

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Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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Cover *Thompson Falls on the Thompson River is one of dozens of spectacular waterfalls in the Jocassee Gorges region. Photograph by Jeff Lepore.* ©1999

Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 1-800-662-7726. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

A Nose by Any Other Name

written by Mary Kay Clark ©1999
illustrated by David Williams

Despite the best efforts of the many plastic surgeons in the world there are still a great number of large, long, bumpy, crooked and otherwise imperfect noses out there. Elephants, Jimmy Durante, rhinos and Rudolph are among the many creatures that are known by their unique noses. Surely one of the most bizarre of these appendages belongs to a seldom-seen creature that spends much of its time underground. The exceptional proboscis belongs to *Condylura cristata*, otherwise known as the star-nosed mole. Yes, this tiny creature actually has a star on the end of its face.

Really there are two stars, one surrounding each nostril, looking like a couple of minute wriggly starfish pressed next to each other. The entire organ is composed of 22 tentacle-like appendages called rays, each nostril being encircled by 11 rays. The rays are enriched with blood vessels and contain highly sensitive tactile organs. And talk about wiggling your nose! Each ray is mobile and can move independently. Star-nosed moles have been observed using the rays to explore and probe items and to manipulate prey and materials used for nesting. Do you need to find something to eat? How about cleaning your house? In the world of the star-nosed mole, the nose can do it all!

In almost everything written about this species, the structures of the star have been described as having tactile and manipulative functions. Yet these are common functions that could be accomplished using the forelimbs and mouth. Such an unusual and highly complex organ must have developed to perform a more specialized function. Does a nose by any other name still smell the same? Scientists wanted answers and found some clues to the purpose of the star by comparing it to another mammal with an unusual nose: the duck-billed platypus. What does an egg-laying Australian mammal have in common with a placental insectivore found here in North Carolina? Surprisingly a lot, as it turns out.

As you'd expect, the star-nosed mole spends a lot of time underground. It also travels above ground quite a bit, but unlike most other moles this species spends a lot of time in the water. In fact, many of their burrows open directly into the water. Star-nosed moles are excellent swimmers and divers, and their diet includes a variety of aquatic invertebrates. The habits of the star-nosed mole are very similar to those of the platypus, which is also a semi-aquatic, fossorial mammal that feeds on worms and small aquatic organisms. Since they have similar lifestyles, could they have common ways of solving problems? And is the answer in their noses?

Well, their noses certainly don't look alike. It's what the flat, bill-like platypus nose does that intrigued scientists. Its bill contains hundreds of small and large pores. The small ones connect with touch receptors and the large ones with features that detect electrical fields. The tactile receptors and the electroreceptors enable the platypus to move about in water and to find food there. Both the star-nosed mole and the platypus move their heads from side to side as they swim and they both hunt for prey in situations that are often dark and murky. Scientists recently speculated that the fleshy rays on the mole's nose might serve as an electrosensory organ that would aid in detecting prey and consequently play a vital role in increasing the mole's feeding success.

To test this, three sets of experiments were conducted. The results supported the idea that the rays do have electrosensory functions. For example, in one test biologists determined the electrical fields at various points on earthworms and recorded the places where the moles bit the worms. Moles favored electrical hot spots on the worm. Some prey items may not produce electrical fields strong enough to be sensed, so even though electrodetection is used the tactile function is still needed.

The poor eyesight of moles is legendary, but who needs good vision when you've got such a fabulous schnoz? And as both the star-nosed mole and Barbara Streisand prove, the odd honker isn't necessarily undesirable.

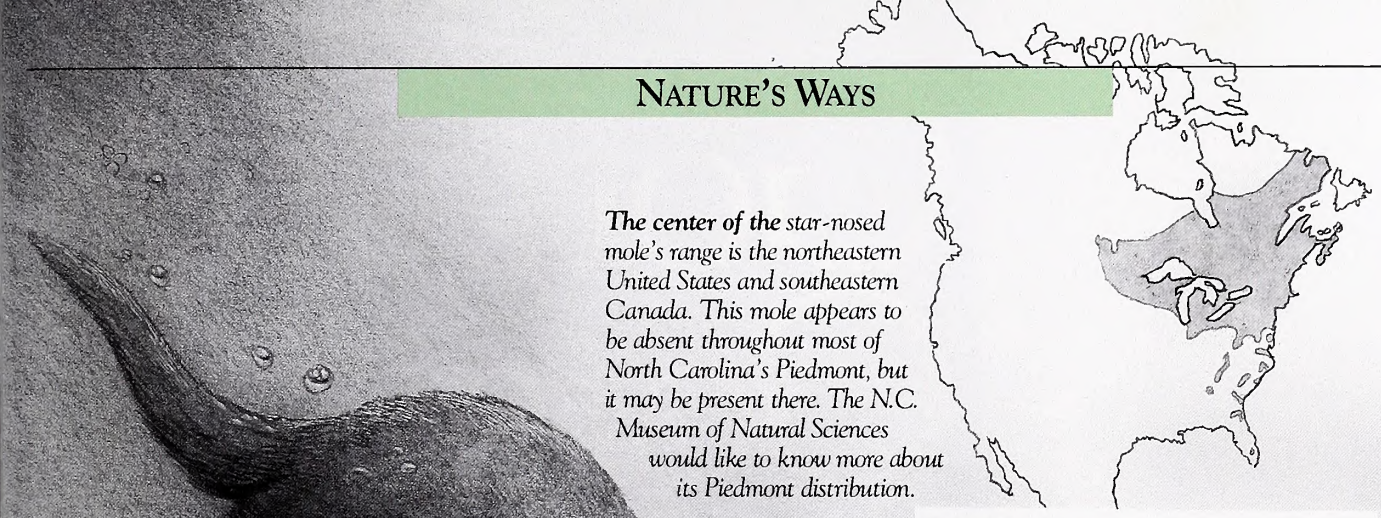
Mary Kay Clark is a curator of mammals at the N.C. Museum of Natural Sciences in Raleigh.

Other Reading

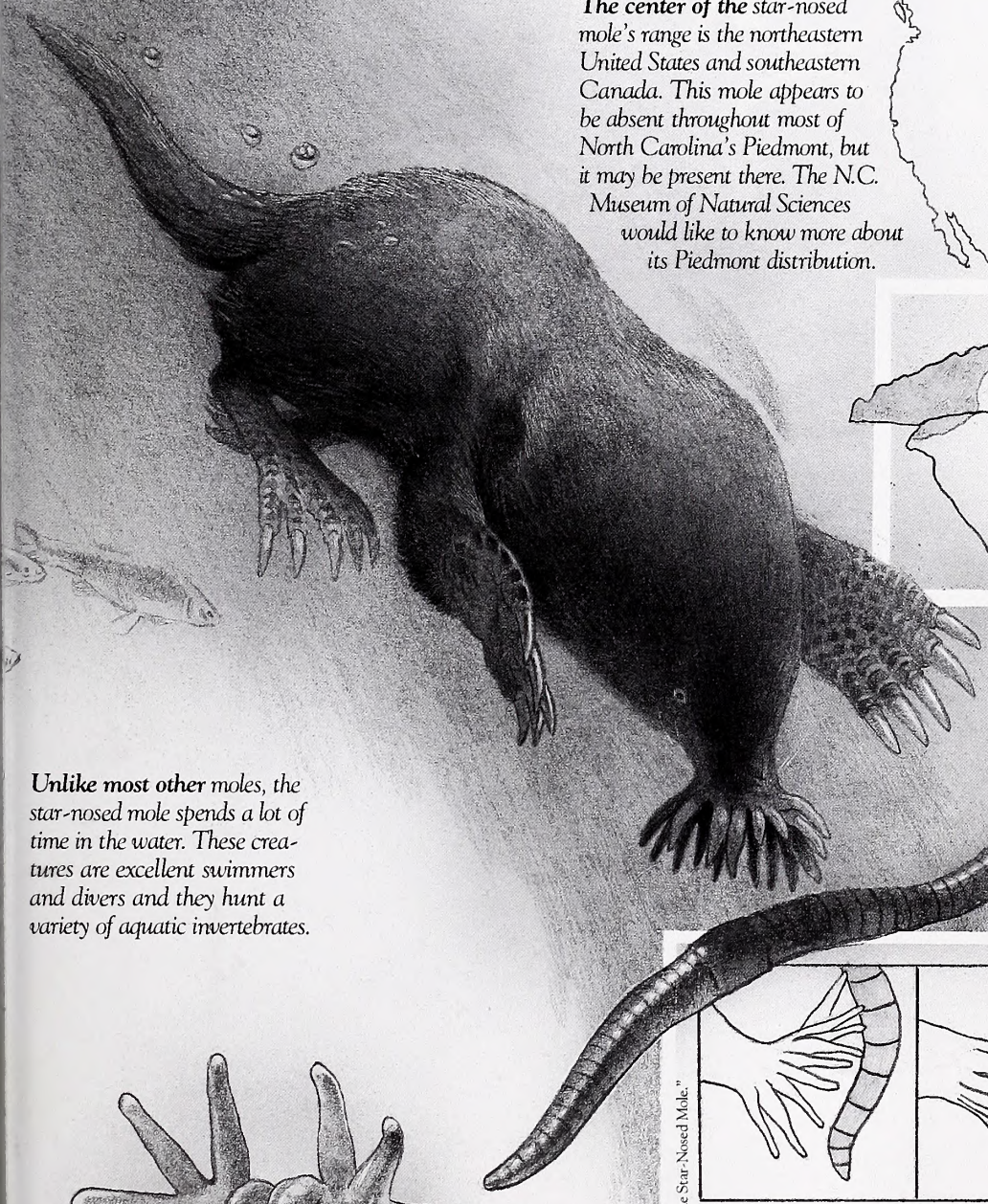
- "Function of the star in the star-nosed mole, *Condylura cristata*," E. Gould, W. McShea, T. Grand. *Journal of Mammalogy* (1993).
- "Life in the Dark Lane," Jane Rohling, *Wildlife in North Carolina* (May 1985).

Surfing the Web

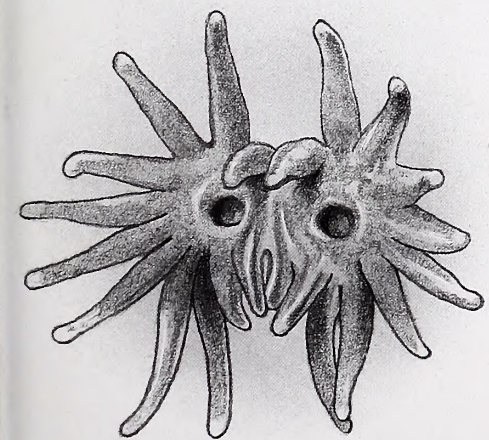
- "Star of the Swamp" has a good written summary of the lifestyle of the star-nosed mole. *Address*: http://www.nwf.org/natlwild/starnose.html
- "Amazing Animal Senses" contains interesting facts about animals with unusual ways of sensing elements in their environments. The site includes some information on the star-nosed mole. *Address*: http://www.weber.u.washington.edu/~chudler/amaze.html



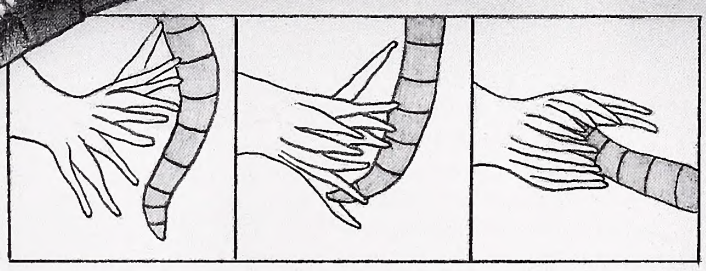
The center of the *star-nosed mole's range is the northeastern United States and southeastern Canada. This mole appears to be absent throughout most of North Carolina's Piedmont, but it may be present there. The N.C. Museum of Natural Sciences would like to know more about its Piedmont distribution.*



Unlike most other *moles, the star-nosed mole spends a lot of time in the water. These creatures are excellent swimmers and divers and they hunt a variety of aquatic invertebrates.*



The fleshy rays *surrounding each nostril are in constant motion when the mole is exploring and feeding. Each ray contains both tactile and electrosensory receptors.*



The star is used for *probing and investigating food items like this earthworm. Experiments show that star-nosed moles bit into worms at points with the greatest electrical charge.*

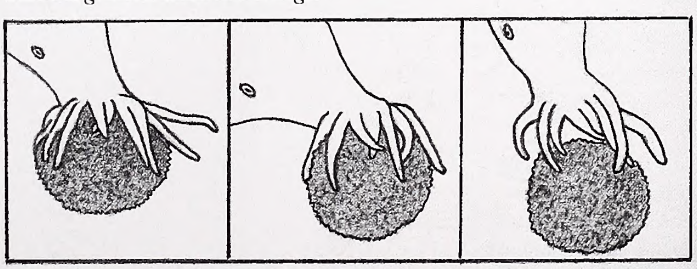


Illustration after Gould Et Al., "Function of the Star in the Star-Nosed Mole."

The rays are also used for *handling other items, such as nesting material. The mole uses the rays to encircle and contain the material so it can be pushed through its tunnels.*

Gorgeous Gorges!

Dozens of rare plant species and the greatest concentration of waterfalls in eastern North America are found in this remote mountain paradise known as the Jocassee Gorges.

written by Ida Lynch ©1999

JEFF LEPORE

Oconee Bells

"Americans find mythic waterfall, garden paradise in Tibetan gorge." The headline on the front page of the newspaper caught my eye. Intrigued, I read about a team of explorers who had ventured into the bowels of what they believed to be the "world's deepest mountain gorge," a 4,000-foot-deep, 75-foot-wide abyss between two towering mountains in the Himalayas. Using ropes to descend into this tortuous chasm, the adventurers found a 100-foot-high waterfall, an untamed river, and a subtropical garden teeming with unusual flora and fauna, including the takin, a rare goat considered sacred to Tibetan Buddhists. There was no previous record of anyone's ever venturing into this fantastic landscape.

***The spectacular High Falls** on the Thompson River is one of dozens that plummet off the Blue Ridge Escarpment from North Carolina into Lake Jocassee in South Carolina. The wet region harbors many rare plants such as the Oconee bells* (Shortia galacifolia).

BILL THOMAS

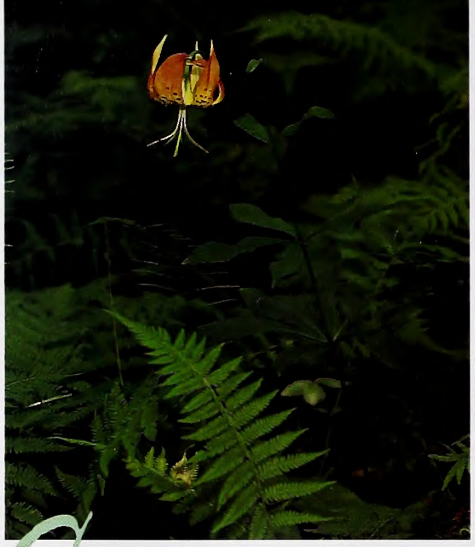
Upper or "High" Falls

The article reminded me of a recent expedition of my own, although unlike the intrepid Himalayan explorers, I did not belay into a chasm too deep to show up on satellite surveillance photographs. Last November, I hiked with a group to Windy Falls on the Horsepasture River in Transylvania County. The Horsepasture is a National Wild and Scenic River that runs through a verdant area known as the Blue Ridge Escarpment or the Jocassee Gorges. Located in southern Transylvania and Jackson counties, this wild land between Rosman and Highlands is bordered by U.S. 64 on the north and the South Carolina line on the south.

The region is part of a larger natural area known as the Blue Wall that extends into the South Carolina Piedmont. South Carolina purchased 32,000 acres of this unparalleled land from Duke Energy (formerly Duke Power Co.) in 1997, and North Carolina and the U.S. Forest Service plan to purchase nearly 12,000 acres from Duke in 1999 to be managed as a game land, a state park and Forest Service land. The North Carolina property is the missing link in a mammoth wilderness block extending west to east from the Chattahoochee, Sumter and Nantahala national forests to South Carolina's Mountain Bridge Wilderness.

The Blue Ridge Escarpment is a massive rocky spine that separates the mountainous Blue Ridge and the low-lying Piedmont regions. In places, the top of the escarpment juts out of the forest in gargantuan rock outcrops. For most of its length, the scarp runs northeast to southwest, forming the divide between the Tennessee Valley drainage on the northwest and the Atlantic drainage on the southeast. Near Hendersonville, the divide turns westward and extends almost 30 miles to Highlands, where it again binds with the escarpment and heads southwestward.

At the turning point near Hendersonville, the escarpment faces due south in a bowl-shaped embayment; this random geographical occurrence accounts for many of the region's curious features. Geologists generally agree that a combination of erosion,



KEN TAYLOR

Carolina Lily

extremely high local rainfall and steep river and stream gradients scooped out this natural amphitheater that is roughly 15 miles wide and more than 2,000 feet deep.

The Jocassee Gorges are saturated by some of the highest annual rainfall amounts in eastern North America. On average, between 70 and 85 inches of rain falls in the area each year, although more than 100 inches of rainfall has been recorded in some years. The south-facing embayment attracts much of this moisture by trapping warm, moist air flowing northward from the Gulf of Mexico and the Caribbean Sea. As the air is funneled over the escarpment, it cools and spawns localized rainy seasons between December and March and during July and August.

Bearwallow Creek and four robust rivers —from east to west, the Toxaway, Horsepasture, Thompson and Whitewater—plummet off the scarp in countless waterfalls as they descend into Lake Jocassee in South Carolina. Over millions of years, the waterways' perpetual passage has carved out precipitous gorges that extend from the 3,000-foot-high escarpment to about 900 feet at their mouth. The gorges are renowned for containing the greatest concentration of waterfalls in eastern North America.

People have been drawn to this land of waterfalls since the Cherokee inhabited a village called Toxaway on the lower stretch of that river more than 10,000 years ago. In the 1800s, before the Civil War, tenacious white settlers established homesites and pastures in the flat river bottoms and subsisted by raising cattle, farming, trapping and making moonshine. By the early 1900s, most of the settlers were gone, but their spirits live on in old cemetery plots on the ridge tops and in descriptive place names such as Bear Camp, Caning Bottom, Burnt Schoolhouse and Horsepasture.

More recent human activities have also left their mark on the landscape. Builders formed Lake Toxaway by damming the Toxaway River in 1961, and in 1973 Duke Power, which once owned close to 60,000 acres in the area, built a hydroelectric pumped-storage reservoir called Lake Jocassee, flooding the junction of the Toxaway and Whitewater rivers. Because the region has primarily been in single ownership since Duke Power began acquiring land in the 1940s, much of the area has escaped the extensive development found elsewhere in the Southern Appalachians.

As we walked through an oak-hickory forest on this overcast day, the logging road beneath our feet was the only reminder of human engineering. Most of the gorges' original forests were lumbered or burned at one time, but the land is recovering and is now cloaked in a dense second-growth forest with scattered stands of old growth. The woods were quiet except for the sound of crunching leaves and the tinkling calls of Carolina chickadees and golden-crowned kinglets.

In November, the migratory songbirds that breed in the gorges were enjoying the abundant fruits and insects in the tropics. But come spring, the birds would be back in the gorges, and the woods would be filled with the feverish serenades of Swainson's warblers, black-throated blue warblers, black-and-white warblers and scarlet tanagers. North Carolina's largest mountain population of Swainson's warbler is thought to inhabit the gorges. This uncommon skulking bird may be declining because of the influence of the cowbird, a parasitic bird that lays its eggs in other birds' nests, and the disappearance of canebrakes, the warbler's preferred habitat in the Coastal Plain. Protecting large blocks of unfragmented wilderness like the Blue Ridge Escarpment is essential to the survival of Swainson's warblers and other migratory bird species, since cowbirds typically do not penetrate sizable forests.

As we neared Windy Falls, the road narrowed into a steep riprap trail, and the sound of rumbling water drowned out our conversation. My first view of this series of cascades that fall 720 feet in less than a mile gave me the distinct feeling that I was the

Green Salamander

HARRY ELLIS

JEFF LEPORE

***Lake Jocassee embraces** the onrushing waters of four rivers that have carved precipitous gorges throughout the region. With some of the highest annual rainfall in eastern North America, these gorges stay perpetually wet, hosting a myriad of ferns, botanical gems like the Carolina lily* (Lilium michauxii) *and amphibians such as the green salamander* (Aneides aeneus).

size of a dust mote. As I watched the water plow over and past the house-size boulders, I began to understand the titanic forces that excavated the deep potholes in the massive rocks. I began to understand how water molds this ancient landscape.

We scrambled through a spongy hemlock forest on the slopes above the river and walked gingerly on a precipitous rock face to get a view of the lower falls. A rock-strewn pool lay many feet below us, and a vast forest of yellow- and orange-cloaked tulip poplars and stately green hemlocks surrounded us.

When I peered through my binoculars at a rock face that appeared to be covered in grass, our leader, botanist L. L. "Chick" Gaddy, identified the plant as Biltmore sedge, one of more than 60 rare plant species found in the gorges. The sedge is endemic, or restricted to the Southern Appalachians; only 30 populations of the plant remain, and 18 of these populations are found in the gorges.

Botanists have been drawn to this plant-rich place since French botanist André Michaux visited here in 1788 and collected a specimen of *Shortia galacifolia*, a close relative of galax commonly known as Oconee bells. His discovery of this showy, spring-blooming plant sparked two centuries of botanical studies in the area.

"Michaux labeled a lot of the species that he collected in North Carolina 'From the high mountains of North Carolina,'" recounted Alan Weakley, a regional ecologist with The Nature Conservancy. "So everyone assumed that he had found *Shortia* at high elevations. In the 1800s, the famous American botanist Asa Gray traveled to high mountains such as Grandfather, Roan and Bluff mountains in search of *Shortia*. He found a lot of great plants, but he did not find *Shortia*! So the labeling of the specimen was misleading, leading to nearly a century of mystery."

Oconee bells was not found in North Carolina again until 1877, when a botanist rediscovered the plant on the banks of the Catawba River in McDowell County. Considered endangered in North Carolina, this Southern Appalachian specialty is found only in the Carolinas and Georgia; up to 90 percent of the world's populations occur in the gorges region. Shortia's nearest relatives are five other species found in China and Japan.

In the early 1900s, botanists became intrigued by the unusual affinities of the gorges' plant life: some plants are endemic

Lower Whitewater Falls

JEFF LEPORE

***Some of the rarest** plant species in the region are found in the spray communities associated with waterfalls such as Lower Whitewater Falls on the Whitewater River. In these moist and sheltered areas, mosses, ferns and liverworts have found perfect conditions to grow undisturbed for millions of years.*

to the escarpment and are found nowhere else; some species are typically found in northern climates; and other species are disjuncts from the wet tropics, meaning that the gorges' populations are isolated from others in the tropics.

Weakley and other botanists maintain that the gorges region is the "most important site in North America for mosses, liverworts and tropical fern species." Many of these species require abundant moisture for at least part of their life cycle, as well as moderate temperatures.

"Down in the bottom of these gorges, the climate is moderated, partly because of the very humid conditions and partly because the sun rarely reaches down into the bottom of the deepest gorges," Weakley explained. "The greenhouse-like conditions foster the growth and survival of these mosses and liverworts."

The unusual distributions of some of the area's moss, liverwort and fern species inspire Weakley to describe the gorges as "a touch of the tropics in the mountains of North and South Carolina." Carolina starmoss, a large, distinctive moss found in the deepest gorges, grows in the Dominican Republic as well as the Southern Appalachians. Single-sorus spleenwort, a fern species found in the gorges, grows primarily in high-elevation cloud forests in Central and South America, the West Indies, Africa and Hawaii.

Most of the embayment's rare plants are associated with uncommon natural communities such as the spray cliff communities around waterfalls, or with rare geologic features like granitic domes. "Spray cliffs are found in close proximity to waterfalls and cascades," Weakley explained. "These vertical wetlands are kept continually moist by the spray from waterfalls or cascades. Many wetland species grow on vertical spaces in these communities. For instance, peat moss or sphagnum grows in vertical sheets on these cliffs." Five species of filmy ferns, fragile plants with leaves only a single cell thick that require constant humidity, cling to these cliffs where few larger plants can survive.

Many of these unique species have probably grown in the sheltered microhabitats of the gorges for millions of years. "The gorges area is an ancient refuge, an area harboring remnant species that once had much wider distributions," Weakley noted. "There is evidence that many of these plants have been here since North America and Asia and Europe were all joined in one continent.

"For example, *Shortia* was once distrib-

uted more widely throughout the Northern Hemisphere, in Europe, Asia and North America. But the climate has fluctuated, resulting in dry periods, followed by wet periods, and so on. In addition, the continents have drifted apart. *Shortia* has been unable to exist in most areas because of these changing conditions. But the gorges have retained constantly moist conditions for millions of years, enabling *Shortia* to thrive here."

These moist, moderate conditions are also amphibian friendly. As we began to wend our way back to civilization, we stopped to admire a lichen-covered rock outcrop dripping with water and spotted a minute black salamander crawling through the wet leaves beneath the overhang. It was a blackbelly salamander, one of at least 16 species of salamanders that inhabit the gorges.

In studying the area's amphibians, herpetologists have concentrated on rarities such as the green salamander (*Aneides aeneus*), considered endangered in North Carolina. Salamanders in the genus *Aneides* are commonly called climbing salamanders because of the arboreal and rock-climbing skills of several of the species. The green salamander ranges from Pennsylvania to Mississippi and is found primarily in the Appalachians; in North and South Carolina, most of the populations are found in the Jocassee Gorges.

Typically inhabiting damp cliffs and rock faces that are protected from the sun and direct rain, the species has evolved several interesting adaptations to aid in mobility and provide camouflage.

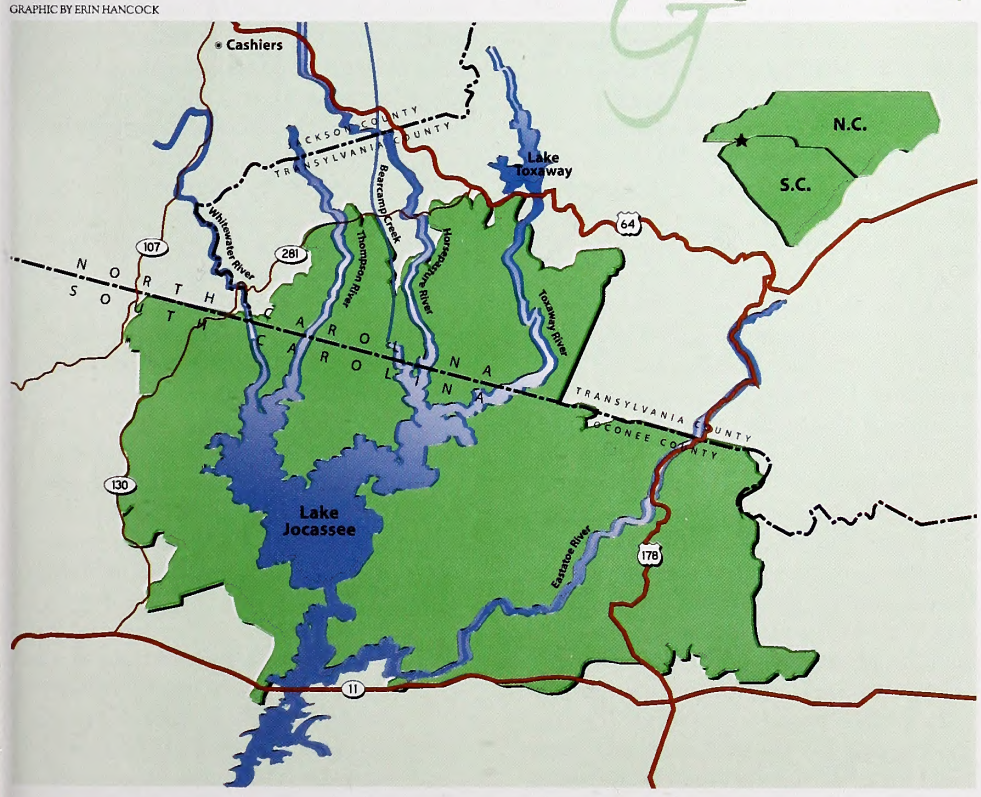
Although biologists have not studied the warm-blooded animals in the area as extensively as the plants and amphibians, we do know that wide-ranging mammals like the bobcat and some of the Southern Appalachians' 7,000 black bears inhabit this roomy natural area, as do wild turkeys and white-tailed deer. Over the next few years, biologists will be studying various aspects of the area's wildlife, mapping sensitive natural communities and rare plant locations, studying mammal populations and searching for rattlesnake dens and rookeries in an effort to deepen our understanding of this important wildlife habitat.

As we walked up the steep trail and the sound of Windy Falls became fainter, I thought about our hike into the belly of the gorge. Although this land is well known for big and brassy natural attractions like whitewater rivers and thundering waterfalls, it also shelters a Lilliputian world replete with its own wonders, hidden to all but the most observant.

Like that legendary gorge in the Himalayas, the Jocassee Gorges' unexplored ravines and cliffs are likely to harbor more rare plants and animals. There is no telling what future ecological surveys will reveal. Maybe we'll find our own sacred goat nimbly bounding down a rocky slope. Let's just hope it doesn't develop a taste for Oconee bells. ⊠

Gorges Country

GRAPHIC BY ERIN HANCOCK



HIKING the Gorges

- Whitewater Falls is one of the most accessible waterfalls in the area, as it is located at a U.S. Forest Service facility with a parking area, rest rooms and paved walkway. From the junction of U.S. 64 and N.C. 281 about 2 miles west of Toxaway Falls, drive 8.6 miles on N.C. 281 South. The entrance to the Whitewater Falls Scenic Area will be on your left.

- Hiking trails along the Horsepasture River will lead you to some of its scenic waterfalls. To reach the trailhead, from the junction of U.S. 64 and N.C. 281 South, drive 1.8 miles south on N.C. 281 to a pullout and trailhead on the left. (Note: Because these trails are rugged and not well marked, refer to the guidebooks listed below when hiking here.)

- The Foothills Trail is a well-maintained, 80-mile hiking trail that extends from Table Rock State Park to Oconee State Park (both in South Carolina) and winds through the lower portions of the gorges in North Carolina. The trail provides access to many of the rivers in the area and offers wonderful wildflower viewing in the spring. For a brochure or to purchase a detailed trail guide, contact the Foothills Trail Conference, P.O. Box 3041, Greenville, S.C. 29602, (864) 467-9537.

GUIDES to the Gorges

The North Carolina Sierra Club's Guide to the Jocassee Gorges, by Bill Thomas. Contact the N.C. Sierra Club at 1024 Washington St., Raleigh, N.C.27605, (919) 833-8467. Web site address: www.sierraclub-nc.org

North Carolina Waterfalls, by Kevin Adams (John F. Blair, 1995).

Highroad Guide to the North Carolina Mountains, by Lynda McDaniel (Longstreet Press, 1998).

REMEMBER: When hiking the gorges, avoid trampling the rare natural areas, particularly the fragile communities around waterfalls.

A Great Place for Salamanders

If there's a salamander heaven, it must be the wet, cloud-wreathed peaks of the Southern Appalachians. This ancient landscape has been a center of salamander distribution for millions of years.

written and photographed by
Harry Ellis ©1999

Each summer evening, with the coming of darkness, a variety of salamanders awaken and begin to stir in our woodlands. They forage for worms, insects and other small creatures among the ferns, mosses and fallen leaves on the forest floor.

Belonging to the order *Caudata*, salamanders are tailed amphibians with slender bodies and usually four short legs. Salamanders are akin to frogs and toads, but unlike their relatives, they are voiceless. Another difference is their ability to regenerate lost body parts. A tail left in the hand that seized it is soon regrown by the salamander.

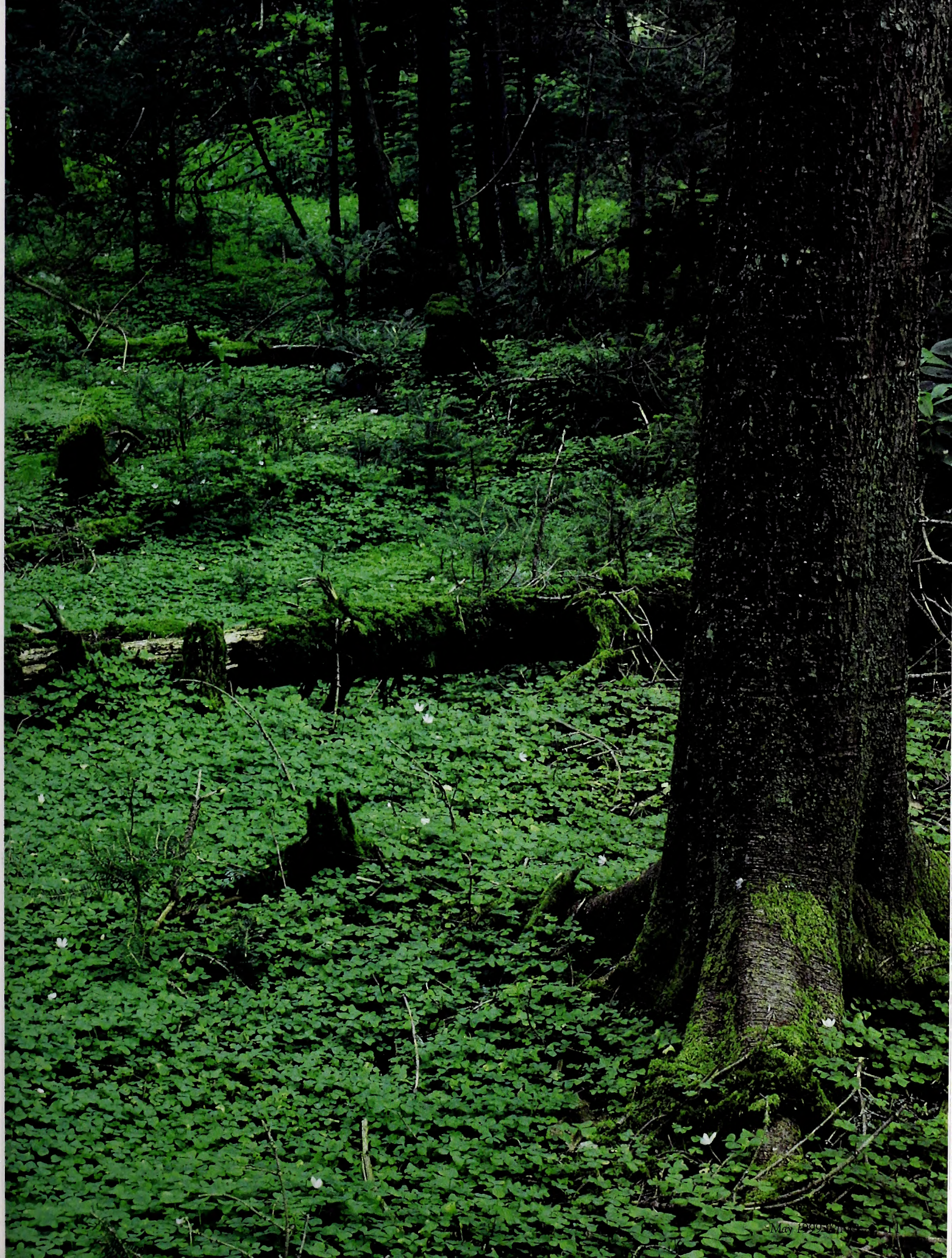
Almost everyone has seen salamanders at one time or another. What youngster who has gazed into the depths of a bubbling spring or raised a rock in the woods has not seen a "lizard" or a "spring lizard"? But these amphibians are not lizards. Salamanders differ from these reptiles in having soft, moist skin and toes without claws, whereas lizards have dry skin covered with scales and they have clawed toes.

At least 110 species of salamanders are found in North America, more than in any other region on earth. The southeastern United States is the world center of salamander diversity, and the southern Appalachian Mountains—which encompass the Great Smokies and the Blue Ridge—are world-renowned for their salamanders, with at least 34 species known. Worldwide, there are approximately 350 species belonging to eight families. However, one family, the Plethodontidae, has 215 species and represents more than half the world's salamanders. Members of this family have no lungs and get their oxygen directly through their moist, porous skins.

The varied and abundant salamander population of Appalachia relates to the topography of these highlands. Here, dozens of towering peaks are separated from each other by deep river valleys and gorges, each of them possessing different characteristics of geology, climate and vegetation. In the ancient past, independent salamander populations became isolated or trapped on certain individual peaks and summits. During eons of time, each group followed its own evolutionary path, resulting in the development of new species and races.

An example of the effect geographical barriers can have on evolution can be seen in a group of black or dark gray woodland salamanders belonging to a single species, *Plethodon jordani*. Individuals of this species in the Great Smoky Mountains have bright red or orange cheek patches and are called red-cheeked salamanders. A few miles southeast of the Great Smokies, in the Nantahala Mountains, members of this species have no cheek patches but possess bright red legs and are called red-legged salamanders. Over a slightly wider area of these mountains, another variation occurs in which individuals,

***The forested highlands** of the Southern Appalachians, with their varied habitats, are a salamander paradise. Here, dozens of salamander species find plentiful niches for living.*



***Isolated from each** other by deep gorges, individuals of the same species have taken different evolutionary paths, resulting in interesting species variations. In the Nantahala Mountains, the species* Plethodon jordani *has red legs (right) while in the Great Smoky Mountains, it has red cheeks (top, facing page). Found over a wider mountain area, a variation, called the Metcalf variation (below), has a different pattern and marking.*

designated the Metcalf variety, are plain black or dark gray with no pattern or markings. In the past, herpetologists separated these color variations into different subspecies or geographical races. But now herpetologists prefer to include them in a single form until more is known about them. As with all members of the *Plethodon* genus, the eggs of this species (*P. jordani*) are laid in moist crevices of hollow logs. Larval development is completed within the egg membrane, and the young hatch looking like well-formed, tiny adults.

Also occurring in the Great Smoky Mountains is the imitator salamander (*Desmognathus imitator*), a member of the dusky salamander clan, which has bright red or orange cheek patches closely mimicking those of the red-cheeked Plethodons of the same general area. Exactly why one salamander appears to imitate another species is difficult to understand.

Many salamanders occur over a wide geographic range. The red-backed salamander (*Plethodon cinereus*) ranged throughout the Appalachians and beyond. Other species are found in an extremely limited area. The Mount Mitchell spring salamander (*Gyrinophilus porphyriticus polystictus*), a subspecies of the spring salamander, is found only in the cold, clear brooks and springs of the lofty peak for which it was named.

To the exploring herpetologist, these cloud-shrouded Appalachian peaks are a veritable paradise, a region of high annual rainfall, rushing streams and foaming brooks. During summer, there is always the sound of singing birds and the clamor of wild bees in the blossoms. For years, scientists from all over the country have come to our highlands, searching for rare, endemic species.

In our mountains, a number of hitherto unknown species of salamanders have been discovered. It was on the fir-clad summit of Grandfather Mountain on August 27, 1930, that a young Ohio naturalist, Worth Hamilton Weller, collected a slender, gold-blotched salamander unlike any seen before. It was a species new to science and was named *Ple-*

thodon welleri in his honor. The following year, Weller and a group of collectors returned to the mountain, but the trip ended in tragedy. Weller lost his footing on the mountain's steep face and fell to his death.

Another notable discovery was made on the same mountain by the eminent herpetologist Emmett R. Dunn. While collecting specimens along the old Yonahlossee Road on the mountainside, he raised a rotting log and discovered a large, eye-catching salamander with a broad, dark red dorsal stripe and a black head and tail. It was a new species, later named *Plethodon yonahlossee*—the Yonahlossee salamander.

Salamanders are extremely adaptable creatures that live in a variety of habitats from the highest mountains to the deepest gorges, caverns and caves. One member of the spring salamander genus, *Gyrinophilus palleucus*, lives in the underground streams of a few Southern Appalachian caverns. This pale pink, larval salamander is nearly blind, with tiny, lidless eyes (functional eyes are not needed in its subterranean darkness). Breeding in the larval state, this salamander is considered neotenic; that is, it retains its juvenile body as an adult. It has a large tail fin and bright red external gills, which it never loses. Found in Tennessee, north Alabama and northwest Georgia, it has not yet been recorded in North Carolina. However, it could turn up at any time, because it was the last of the cave-dwelling salamanders to be discovered, and its complete range is unknown.

Southern Appalachian salamanders vary in size from the 1½-inch pygmy salamander *(Desmognathus wrighti)* of the higher-elevation spruce-fir zone to the 18-inch hellbender *(Cryptobranchus alleganiensis)*. These massive wrinkled salamanders can live only in clear, unpolluted streams and rivers. Because of pollution, the hellbender has become rare in many areas of the Appalachians.

A number of our salamanders, unlike the grayish brown hellbender, are among nature's most strikingly colored creatures. The bright coloration of the red salamander *(Pseudotriton ruber)* suggests a brilliant exotic from the tropics. Other colorful salamanders include the reddish orange Blue Ridge spring salamander *(Gyrinophilus porphyriticus danielsi)*, which inhabits the region's cold springs and brooks, and the green salamander *(Aneides aeneus)*, a cliff dweller with expanded toe tips and green, lichenlike markings over its body. Several of the brook salamanders of the genus *Eurycea* are very attractive and graceful in appearance. These include the Blue Ridge two-lined salamander *(Eurycea wilderae)*, which lays its eggs on the underside of a stream boulder and guards them until they hatch, and the brightly colored long-tailed salamander *(Eurycea longicauda longicauda)*, which has a tail almost twice its body length.

The red-spotted newt *(Notophthalmus viridescens viridescens)* has a complex life history. From an egg laid in the water, the young newt hatches as a gilled larva that loses its gills when it is a few months old, develops lungs, changes its dull coloration to a brilliant red and ventures out on land, where it is called a red eft. After

In late winter, *spotted salamanders move to woodland ponds where they mate and lay globular masses of eggs (above). After hatching, the tiny larval salamanders will feed and develop. By July, they will leave their aquatic habitat for a terrestrial life.*

remaining for two or three years as a land-dweller, the red eft undergoes yet another transformation. It changes to a yellowish or olive brown color with red spots and develops a large tail fin for swimming as an aquatic adult. The salamander experiences an overpowering impulse to seek the water that it left so long ago, and, finding it, the eft glides into the depths of its final home.

Among many species of dusky salamanders (*Desmognathus*) is the Appalachian seal salamander (*Desmognathus monticola*), which is abundant along almost every brook and stream. There is also the mountain dusky (*Desmognathus ochrophaeus*), which is extremely variable in color, appearance and pattern, with individuals ranging from black and brown to bright shades of red, orange and yellow.

The shovel-nosed salamander (*Leurognathus marmoratus*) is a large, water-dwelling salamander of fast-flowing, boulder-filled mountain streams. Mottled in shades of gray, buff and brown, it blends so well with the rocks and pebbles on the stream bottom that it is difficult to see. Because of its camouflage and remote habitats, it is seldom seen except by collectors and naturalists searching for it.

Members of the mole salamander family, Ambystomidae, spend most of their lives in underground burrows but emerge for a brief period each year for mating and egg laying. They adhere to the ancient pattern of depositing their eggs in the water, and their young go through an aquatic gill stage. Among this group are the marbled and spotted salamanders and the Eastern tiger salamander (*Ambystoma tigrinum*), which has a maximum length of 13 inches and may be the world's largest terrestrial salamander.

The marbled salamander (*Ambystoma opacum*) is jet black with irregular white or silvery bands that give it a marbled appearance. Unlike others of her kind, the female waits until early autumn to lay her eggs, which she deposits in a shallow depression near a pond, but never directly in the water. When the first autumn rain fills the cavity and covers the eggs, they hatch, and the young wriggle into the pond where they remain until time to change to adults.

The spotted salamanders (*Ambystoma maculatum*) breed in our southern mountains in late February and March. The spotted salamander is about 7 inches long and glossy black, with a row of bright yellow spots down each side. It is one of our most common species, yet few people have ever seen it, because nearly all of its life is spent underground. Once each year, for a brief period, these amphibians come from their hiding places by the dozens and migrate to woodland ponds for breeding.

On a certain night when the rain is falling, myriads of them will come out of the ground almost simultaneously, as if a mysterious signal had swept through the earth. Possessing an amazing navigational sense, they clamber over all obstacles to reach their pond, which may be a quarter of a mile away. In the pond, both sexes engage in a type of courtship dance—a thrashing, wheeling mass of black-and-yellow bodies.

After mating is over, each female lays one or more globular masses of eggs, encased in a clear, jelly-like substance, attaching them to plant stems and sunken tree branches. Soon the pond will be alive with larval spotted salamanders that will be ready, by July, to leave the water for a life on land.

Every year, as the days of fall become cooler and shorter, the same shadowy force that tells the birds when to migrate, impels our land-dwelling salamanders to seek burrows and deep holes in the earth as a refuge from the approaching winter. With the flame of life turned low, they pass through winter's cold in a state of hibernation. Then, magically, the lengthening days filled with sunshine bring the sleeping earth to life again, and salamanders awaken to begin their life cycles anew. ⊠

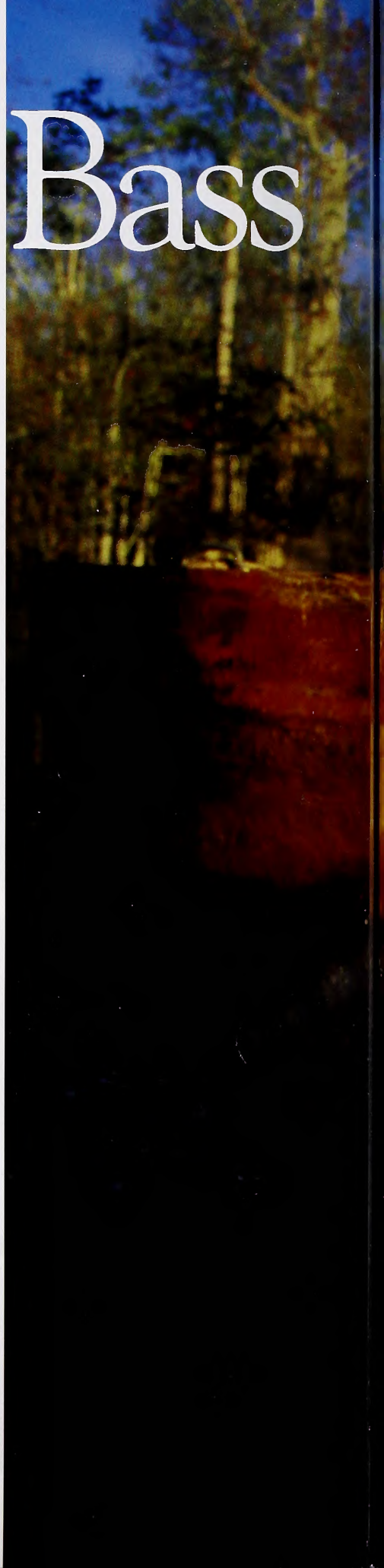
The Eastern newt *moves from water to land back to water again. After hatching and spending some months as an aquatic larva, it changes into a subadult form, called the red eft (above), which spends several years as a terrestrial salamander. Eventually, it returns to the pond as an adult with a completely different form. Its tail has thickened into a fin and it sports iridescent red spots (left).*

Pond Bass and the Tactical Fisherman

JIM DEAN

You don't have to worry so much about finding bass in a pond, which is why these small waters are perfect test labs for tactics.

written by Jim Dean ©1999



F. EUGENE HESTER

As usual, Jack Avent and I had loaded the 12-foot boat to the gunwales with far more tackle than anyone would think we might need—six rods apiece and enough lures and other gear to stock three aisles at Wal-Mart. But it wasn't because we were going to probe some 20,000-acre impoundment. We were getting ready to fish a 2-acre farm pond.

"We've done it again," I said, picking the scab off an old running joke. "We ain't even got room for our feet."

"Yeah, I know," Jack said. "But during the next two hours, every bass in this pond is going to get a chance to see our lures. I want to make sure I've got at least one they like."

That seemingly chance remark neatly sums up one of the biggest differences between bass fishing in ponds and bass fishing in huge lakes and reservoirs. Arguably, the biggest challenge facing big-lake bass fishermen is finding fish. Even if you have lots of experience, that isn't always easy. In fact, you can be on top of a wad of bass and still not know it simply because you're using the wrong lure, or the bass aren't feeding.

But even in relatively big ponds, finding bass isn't a big problem. You've got very nearly a captive audience, and you can concentrate on pure tactics with confidence that bass are evaluating your offerings on nearly every cast. Even if you're reduced to pure trial and error, it seldom takes long to figure out what will, or won't, work. And if bass really aren't feeding, that is usually obvious pretty quickly, too.

It's this confined nature of ponds that makes them such wonderful test labs for bass anglers. Ironically, it means a pond fisherman may actually need a greater variety of gear than the big-lake angler does. Ultralight spinning and fly fishing, for example, have limited application on most big lakes, but they're sometimes your best choice on small, shallow waters, and they're practical additions to your normal arsenal of bait-casting, flipping, pitching and standard spinning outfits. Furthermore, since some big-lake gear is well worth adapting to pond

fishing—portable depth finders, for example—it's easy to see why foot room might come at a premium.

I used to have doubts about the value of a depth finder for ponds because I figured I was covering all the good spots even if I couldn't see them. Besides, cynic that I am, I suspected that those blips on the screen we think are bass are programmed into the system at the factory just to give us something to look at. Even so, being able to determine accurate depths is a definite advantage. More important, since many ponds have so little cover or structure—making what's there all the more important—it makes sense to be able to pinpoint prime spots you can't see.

The battery-powered, portable depth finder I bought made a huge difference right away. One 4-acre pond that I thought had 8 to 10 feet of water in it turned out to be an almost flat-bottomed, featureless bowl with a uniform depth of about 4 feet. Sure, I could have determined that by dropping the anchor here and there, but it would be hit or miss, not to mention a lot of trouble. And I would never have found that one small pile of limbs in 4½ feet of water halfway up the middle of the pond. Knowing it was there, I moved within range early one morning that spring, made one cast, and caught a 9½-pound bass.

Many ponds have that kind of potential, especially if you fish them carefully and take time to experiment. For what they might be worth, here are a few tips and tactics that have often worked for me. Of course, nothing is foolproof in fishing. But even if you have a poor day on a pond, there aren't likely to be any witnesses—unless you bring them.

When Size Matters

Some of the best pond fishing I've enjoyed has occurred when the water was stained or muddy, or when the wind was creating a good ripple. Not only do such conditions help hide you, they also tend to increase the effectiveness of lures that are large or noisy, or both. But most ponds are not only fairly small and relatively shallow, they are likely to be sheltered, with water that is calm and often clear.

While your favorite standard-size (⅜- to ⅝-ounce) lures will work fine most of the time, there are times when I suspect that they spook fish by landing with a big splash, or making too much noise on the retrieve. A more subtle approach sometimes works better.

***Small lakes and** farm ponds are the perfect waters for testing largemouth tactics and tackle because you're virtually assured that some bass are within range of every cast. The challenge is to key in on the right presentation and lure to entice a lunker to strike.*

JIM DEAN

***Though the most** consistent pond fishing occurs during stable weather, bass will often feed heavily just prior to the arrival of a cold front. Fishing during this time can often pay off in big dividends. For safety's sake, make sure you get off the water when the front finally arrives.*

One solution is to simply switch to smaller lures. Many old favorite hard plastic and wooden lures are available in smaller versions, and so are soft plastic worms, salamanders and similar wriggly enticements. You'll almost surely catch more bass in ponds on smaller lures, and even big bass seem to like these downsized meals. Keep in mind, however, that small versions of some larger lures don't have the same enticing action as their seniors. And don't go so small you that you wind up catching mostly panfish.

This is where ultralight and light spinning outfits equipped with 4- to 10-pound test monofilament are at their best. These may be impractical on large lakes much of the time, but they're ideal for casting small soft plastics, crankbaits, floating-diving lures like Rapalas and downsized topwaters in ponds.

Bass bugging with a fly rod is also great fun, and fish that are spooked by large, noisy lures may actually be attracted to the soft "splat" of a cork or deer-hair bug. I prefer bugs tied on a No. 6 hook with a white or yellow belly, but bigger bugs will work, too. You may be amazed at the size bass you catch, but be aware that pond bass often slurp floating bugs so quietly that you may think a bluegill has sucked your bug in until you set the hook.

Light Weight and No Weight

It's not exactly hot news that artificial worms, salamanders and other soft plastics are killers for bass. However, it pays to adapt their use to the special characteristics of ponds. Most of your casts will be to shallow water, sometimes less than a foot deep. Yet, far too many of us use heavy weights more appropriate for big, deep lakes. Not only do large weights make a bigger splash, they hamper the action of the lure and carry your plastic worm or salamander to the bottom so quickly that bass are less likely to grab it on the way down.

Now, imagine a squiggly salamander working its way through grass or lily pads, dropping off into open pockets with tail and legs fluttering as it slowly sinks. Or imagine that salamander gently, and naturally, sinking alongside a stump or tree lap in deeper water. Bass also think it looks more enticing. You don't need a heavy weight to fish most ponds—just patience.

I have come to the conclusion that

a ¼-ounce weight is usually more than enough, and I now frequently fish worms and salamanders—even floating soft plastics like jerk worms—Texas-rigged without any weight other than a hook big enough to allow them to sink slowly.

From Bank or Boat?

Though I prefer to fish from a boat, where I can build a convenient nest of gear all around me, I've found it's more effective to fish some ponds from the bank because you're less likely to spook fish. That's particularly true of small pasture ponds that are little more than big bowls with little or no cover and relatively clean bottoms. They may not look fishy, but the cautious bank fisherman may discover that they can hold big surprises.

Your favorite pond lures should work, but you may also want to adapt a big-lake tactic—a Carolina-rigged soft plastic French Fry or similar lure—to probe the deeper parts. Casting from the bank is also an effective way to fish a pond at night. Regardless of whether you fish from boat or bank, take your time, and fish with extra care that first time around the pond. The second and third time around are usually less successful.

Gee, That Lure Looks Painfully Familiar

Bass have good short-term memories, and they particularly remember a lure that has grabbed them by the jaw and yanked them out of the water. If it's true that bass in ponds are almost certain to see your lures, that also means those bass can quickly become familiar with your favorites and learn to avoid them. So what do you do when your hot lures go cold? Try other lures, and keep switching lures and tactics until you find a pattern that works, or decide it's hopeless.

One trick is to try lures in those new, vibrant colors. Some of the most garish will often catch bass when nothing else will. One of the most effective "wake-up" lures I've used recently is a brightly colored, straight worm (Zoom Trick Worm) Texas-rigged, but unweighted, on 10-pound test spinning gear. My favorite color is a fluorescent red called Methiolate, but these worms also come in pink and other bright colors. These can be fished on the surface, even over heavy cover, or allowed to sink slowly, and they can be deadly. If the bright colors don't work, try these worms in duller colors such as June-bug and Green Pumpkin.

Typically, lures in wild colors will catch lots of bass the first few times you use them, but bass seem to learn to avoid them even more quickly than lures with natural finishes. When the brief, passionate love affair is over, you can sometimes rekindle the flame in the same pond by waiting a few weeks before you use them again. Or try them in another pond where the bass haven't seen them yet.

Morning, Evening and That Misunderstood "Dead Time"

From spring through early fall, the best fishing is usually early in the morning or late in the afternoon. But contrary to popular belief, the peak of late afternoon fishing rarely occurs at full twilight just before dark. Indeed, bass often become active before sundown as the shadows first begin to lengthen. Fish the shady spots early, and save your best spots to try just after sundown, when the action usually peaks. If you wait too late, you'll miss the best of it, because bass often quit feeding just when tradition says fishing should be best. Though there are exceptions, this phenomenon is so predictable that my friends and I call it "the dead time."

Fish the Weather Fronts

Generally speaking, I believe the most consistent warm-weather fishing occurs during stable weather. However, one exception that seems to hold true for ponds, as well as most other waters, is the concept of fishing weather fronts. Fishing will often be good just before the arrival of a cold front, but poor immediately after the front passes. Some blame a northerly wind, others say it's barometric pressure, but who really knows why? It's only important to be aware that fronts can affect fishing, so you can plan your trips accordingly.

Bad-Water Bass

Don't ignore a pond just because it's old and out of balance. Many older, unmanaged ponds typically hold lots of stunted panfish that are competing with golden shiners, crappies and other species considered undesirable in small waters. Yet, bass that survive the heavy predation during spawning have ample food in all sizes, and there's a good chance some will grow very large. Those bass may be well fed and hard to catch at times, but they are well worth pursuing.

On the other hand, ponds that are carefully managed and fertilized may contain lots of big bluegills and shellcrackers—that's the goal, after all. And though there may be lots of bass, they will tend to be small. That's partly because bass can eat the same food as those big panfish until they reach a pound or so, but they have trouble finding enough midsized forage to grow big enough to eat whopper panfish. Such ponds are still fun for bass specialists who like fast action, and there's always a chance you'll hook a bass that has managed to break through the food gap and considers a 1-pound bluegill a snack.

Here's hoping you catch him. Or I do. ⊠

Finding Good Bass Ponds

JIM DEAN

Although most of the more than 100,000 farm ponds in North Carolina are private, you should be able to secure permission to fish one or two near your home. The best way to get permission is ask politely, promise to close gates, leave no trash and respect the owner's rules (he may want you to release bass, for example). It won't hurt to take him an occasional mess of dressed bluegills or offer to fertilize the pond. Always call in advance, and never extend the owner's generosity to other anglers.

BIG HOPES for small game

MELISSA McGAW

The new and souped-up CRP program is pumping hundreds of millions of dollars into landowners' hands, and wildlife biologists are expecting big dividends for small game in the bargain.

written by Chris Powell

The past 20 years have been frustrating for wildlife biologists trying to manage bobwhite quail and cottontail rabbits in North Carolina. These small game populations have plummeted, mostly because of widespread land-use practices that are not easily correctable.

Once upon a time, almost every farm had a healthy number of weedy field borders and overgrown ditches. Many of those overgrown areas were maintained by periodic fires, discing or hand chopping, which resulted in a steady supply of early successional vegetation. Unintentionally, farmers were creating ideal cover for small game, which flourished.

But during the past few decades, our rural landscape has changed. Economic pressures have dictated that farms and woodlands be managed more intensively, providing isolated islands of habitat, at best. Nowadays, almost every foot of a field is plowed, and what few weedy areas remain are kept meticulously cut. Also, the negative connotations of the word "weeds" really can't be underestimated. Weeds are considered the enemy of agriculture and a sure sign of a lazy farmer. As a result, millions of dollars are spent annually on herbicides and the use of bush hogs (lawnmowers for tractors) to "clean up" farms. Unfortunately, those lost brushy and weedy areas are an essential component to farm wildlife.

But technology is not all bad. Farmers are slowly turning to wildlife-friendly practices such as no-till planting, which leaves harvested crops in the field. Wildlife biologists also see the potential to make significant gains by teaming up with various federal and state programs designated to improve water quality. If properly imple-

KEN TAYLOR

Thomas Padgett, *a biologist with the Wildlife Commission, gives Columbus County landowner Crockett Wilson (at right) some pointers on field borders that should increase small-game populations on his land while protecting water quality. Donna Register (second from left), a district conservationist with the Natural Resources Conservation Service, and Dennis Hosack, a liaison biologist with the Wildlife Commission, also offer their expertise.*

mented, these programs could significantly boost small game populations in the state.

One effort that holds a lot of promise is the Conservation Reserve Enhancement Program (CREP), which was approved for the first time this year in North Carolina. Available in only six states, CREP is a souped-up version of the old Conservation Reserve Program (CRP), which focuses on preventing soil erosion. Though the main thrust of CREP is to improve water quality, improved wildlife habitat has become an important secondary aim, and the potential impact of this is huge. To put it into perspective, about $300,000 was budgeted this year for the state's Wildlife Habitat Incentives Program (WHIP). During the next five years, $274 million will be budgeted for CREP, which will have a continuous sign-up period. The five-year goal is to have a total of 100,000 acres of cropland in the program, with 85,000 of that in riparian buffers and grass filter strips, and the remainder in riparian wetlands.

Using water quality programs to benefit wildlife is not a new concept. Midwestern states such as Nebraska and the Dakotas have been doing it for years with remarkable success. Maryland was one of the first states to get the CREP program in 1998. Already, landowners have agreed to put more than 6,000 acres into the program, said Anne Lynn, a Maryland biologist with the Natural Resources Conservation Service (NRCS). "We have had almost more interest than we can handle in some cases," Lynn said. "After one year, we have 564 contracts with 6,500 acres in the program. We also have another 250 contracts pending."

Terry Sharpe, small game project leader for the N.C. Wildlife Resources Commission, is optimistic those same results can happen here.

"This is where the Wildlife Commission is putting its hopes," Sharpe said. "The success of CREP may very well determine the future of some small-game populations in this state."

The new program seeks not only to control soil loss, but also to improve water quality in the areas of the Chowan, Neuse and Tar-Pamlico river basins as well as the Pamlico Sound, and Jordan Lake watershed areas.

The two main causes of water degradation are sedimentation and nutrient loading, both of which can be traced to agricultural practices, among other things. Environmental officials believe water degradation can be significantly reduced if farmers plant vegetative field borders. The root systems hold soil together and also serve as filters removing fertilizers and nutrients before they run off into streams or ditches.

The old CRP program focused on removing "highly erodible" land from cultivation. Conservation agents would assist farmers to prevent topsoil loss by helping them plant trees and grasses such as fescue, a type of low-growing, sod-forming grass. Though planting fescue is a good way to prevent soil loss, it's terrible for wildlife, said Dennis Hosack, an agricultural biologist who acts as a liaison between the Wildlife Commission and the NRCS.

"Planting fescue on a piece of property is just slightly more beneficial to wildlife than paving that same area with cement," he said. "It's pretty tough for quail, especially chicks, to move around in, and the insect counts are significantly lower in fescue."

Hosack and other wildlife biologists are working with district conservationists to promote the use of native warm-season grasses through CREP. The feeling is that if a program is going to promote vegetative strips, why not have those areas planted in a wildlife-friendly manner? Quail and rabbits need warm-season grasses such as switchgrass and Eastern gamma grass, which grows higher and in clumps. This type of vegetation enables

KEN TAYLOR

***New programs like** CREP are pumping millions of dollars into helping landowners conserve soil and water while also increasing small game. By walking landowners' property, wildlife biologists can get a good idea of what will most benefit wildlife on that land. In addition, biologists can enroll property owners in state and federal cost-share programs that will help offset expenses incurred creating habitat.*

Got a Question?

For more information, call Wildlife Commission liaison Dennis Hosack at (919) 873-2175, or your local agricultural extension agent.

birds and rabbits to feed and move, while remaining protected from predators.

"You need field borders that connect islands of habitat, so small game can move without detection," said Tommy Padgett, a Wildlife Commission biologist. "If a quail has to move across an open field to get to a food source, it's going to get zapped."

Unlike CRP, the "enhanced" version only requires that a farm meet two basic criteria for automatic qualification: it must exist in a designated CREP area and have been cropped two out of the last five years, or be located on highly erodible pasture land. Landowners can put sections of a field or pasture into the program, provided the areas are adjacent to a stream, ditch or wetland. Anywhere from 20- to 350-foot-wide segments of a field can be planted in grasses, and 30- to 350-foot-wide sections can be planted in trees. The program will target hardwood trees such as oaks, which provide quality habitat for wildlife.

Why would farmers want to take sections of their farms out of production? In addition to land stewardship, the answer is money. It's getting increasingly harder to make a living farming in North Carolina, and the state and federal governments are willing to make sizable payments on land no longer being worked. In the CRP program, land taken out of production received an annual rental payment of $28 to $68 per acre (based on soil type). Under CREP, land planted in grass filter strips can receive the previous annual rental rate multiplied by 1.7 plus $5. Property planted in trees can realize twice the former rates plus $5. In addition, cost-share money up to 100 percent is available to help pay for whatever work is done. For example, if it costs $100 to disc and plant a field border, most, or possibly all, of that expense will be reimbursed by Uncle Sam.

The program is already beginning to attract notice in North Carolina. Wayne Short, a district conservationist with NRCS, said he currently has about 100 people waiting to take advantage of CREP. "You can put three to five times more land in the CREP program than in CRP (continuous signup) and the pay is 40 percent more on average," he said. "Money is a critical issue in farming. There are a lot of people who can't rent land around here for what the CREP program can pay."

Often, the least productive portion of a farm is located near wetlands or low-lying areas where soil types change and tree canopies shade sunlight. However, these areas are considered vital for water quality and wildlife. That's why the CREP program is willing to pay farmers such as Jo Anne and Henry Hale, of Halifax County. The Hales have a cattle pasture they believe could be put to better use.

"Farming has gotten really iffy in the last few years, so we just decided we would check into the CREP program," Ms. Hale said. "We have cut trees before, and I believe in replacing what you take out. We're thinking about putting 20 acres in trees."

Short said many Halifax farmers he has spoken with have expressed an interest in planting trees through CREP. Most are like the Hales and want to get out of the cattle business. "The profit from cattle works out to be about $22 or $23 per acre if you're lucky," said Short, who owns a farm in Halifax County. "Trees can average making $200 per acre, per year at today's prices. You just have to be able to wait a while to get paid."

Bill Purvis, a trust farm specialist with Centura Bank, said he is considering putting a number of acres into the program. As a farm manager, Purvis tries to make farms as

*EQIP- *Environmental Quality Incentives Program*; **WHIP**- *Wildlife Habitat Incentives Program*; **WRP**- *Wetlands Reserve Program*

1999 Conservation Programs at a Glance

Program	Purpose	Contract Length	Eligibility (Applicant)	Eligibility (Land)	Sign-Up Period	Evaluation of Applications	Cost Share Rate
CREP	To protect soil and improve water quality and wildlife habitat	10, 15, 30 years or in perpetuity	Individuals and/or groups who have owned land for at least 1 year	Land must exist in CREP zone and cropped 2 of past 5 yrs or marginal pastureland	continuous for five years	based on eligibility, non-competitive	Up to 100% of establishment cost plus ann. payment
CRP Continuous	To protect soil, water, wildlife habitat and to improve water quality	10 to 15 years	Individuals and/or groups who have owned land for at least 1 year	Cropland (cropped 2 of past 5 yrs) or marginal pasture-land	continuous, throughout the year	based on eligibility, non-competitive	50% of estab. cost plus ann. payment based on soil rental
CRP Standard	To protect soil, water, wildlife habitat and to improve water quality	10 to 15 years	Individuals and/or groups who have owned land for at least 1 year	Highly erodible cropland (cropped 2 of past 5 yrs) or cropped wetlands	as announced by Sec. of Agriculture	competitive, environmental benefits/cost	50% of estab. cost plus ann. payment based on soil rental
*EQIP**	To address significant natural resource concerns on agricultural lands	5 to 10 years	Livestock or agricultural producers and landowners	all land uses	continuous, w/ designated rank periods	competitive, environmental benefits/cost	75% of inst. cost, not to exceed a predetermined avg.
*WHIP**	Develop wildlife habitat, especially on field margins and riparian areas	5 to 10 years	Landowners, tenants, associations, or organizations w/ 5+ acres	any non-federal land or riparian areas	continuous, w/ designated rank periods	competitive, environmental benefits/cost	75% of predetermined avg. (50% avg. cost for tree planting)
WRP Permanent Easement*	Restore and protect wetlands and riparian areas	Perpetual	Individuals and/or groups who have owned land for at least 1 year	Prior converted wetland (PC), farmed wetland (FW), riparian areas	continuous, throughout the year	competitive	100% of restoration cost + 100% of land value up to county cap
WRP 30 year Easement*	Restore and protect wetlands and riparian areas	30 years	Individuals and/or groups who have owned land for at least 1 year	Prior converted wetland (PC), farmed wetland (FW), riparian areas	continuous, throughout the year	competitive	75% of restoration cost + 75% of land value up to county cap
WRP 10 yr. Restoration Agreement*	Restore and protect wetlands and riparian areas	10 years	Individuals and/or groups who have owned land for at least 1 year	Prior converted wetland (PC), farmed wetland (FW), riparian areas	continuous, throughout the year	competitive	75% of restoration cost
Forest Stewardship Program	Protect soil, water, wildlife; provide sustainable forest products and recreation	10 years	10-1,000 acres	Forestland 10-1,000 acres	continuous	non-competitive	Up to 75% avg. cost

profitable as possible for the landowners he works for. He believes the bottom line, in many cases, can be increased by planting timber. But he also sees money-making potential in weedy field borders (filter strips).

"We plan to put some property in trees and some in filter strips," he said. "If we can enhance the wildlife on a farm, that will make the hunting rights on the farm just that much more valuable."

If there is any catch to the program, it's that the designated land must be taken out of production for periods of 10, 15, 30 years or in perpetuity. The designated land, once under contract, can be used for no other purpose than what was agreed upon. Because it takes time to realize the environmental benefits, the state kicks in a one-time, up front bonus for 30-year and permanent contracts. In addition, the N.C. Conservation Tax Credit Program provides a final incentive if land is placed in the program in perpetuity.

"A landowner who chooses to do an easement in perpetuity, would be eligible for a tax credit against their North Carolina income tax," said Bill Flournoy, an environmental analyst with the Department of Environment and Natural Resources (see "A Green Choice at Tax Time," *Wildlife in North Carolina*, Feb. 1999).

Hosack said he is stressing to farmers that the program is not necessarily looking for large amounts of land to be set aside. Instead, if farmers work their best land and place small amounts of their low-yield portions in the program, wildlife will benefit tremendously.

"If you agree to put an acre of land into the program, that is equivalent to a 20-foot field border that is about 2,178 feet long," Hosack said. "If someone has a 300-acre farm, one acre is not much of a sacrifice. But more than 2,000 feet of buffers is a lot of habitat that can do great things for wildlife." ⊠

JACK DERMID

***All these young** rabbits need to thrive is a natural food source and shelter. By promoting wildlife-friendly habitat on farms, biologists hope to jump-start dwindling cottontail and bobwhite populations.*

Top of Her Game

Pointers have dominated the national field trial circuit for decades, but that's all changing now thanks to a Tar Heel setter named Priscilla.

written and photographed by
Mike Gaddis ©1999

"In one of the most stunning all-age exhibitions ever to grace the storied piney woods of Hoffman, Priscilla had so bested the competition that the judges felt it would diminish her performance to name a runner-up."

As most bird dog enthusiasts likely know, pointers have dominated the field trial circuit for most of this century. Sure, the venerable setters outmatched their pointer competitors well into the 1910s. But the newer-breed pointers with their superior ranging ability and endurance in hot climes have nosed out the top national field trial events ever since. The pointer dominance has been complete at the national level since 1970 when the last setter, Johnny Crockett, took top honors at the National Championship—the Superbowl of field trialing held in Grand Junction, Tenn.

But an English setter, Tar Heel-born and bred, is bringing back the glory for setterdom. Her name—Ida O Priscilla.

Priscilla was an ordinary pup born in 1993 to Charles Collicutt and Angie Hall of Kernersville. "Ironically, she was the runt," Angie noted. But her pedigree would soon prove she was destined to be a special dog.

The couple had been trying to breed a levelheaded gun dog. Charlie had acquired a homebred setter bitch named Kirk's Nancy, who had the flash and fire but was a bit of an outlaw. They needed a bird-sense stud dog to level the equation.

Madison's Dan was the answer. He was advertised as the "best bird dog in North Carolina," and there was a fair bit of corroboration to back it up. Virtually white, with little ticking, he was physically imposing, sensible and all gun dog.

"We bred to Dan looking for gun dog prospects, not field trial contenders," Charles explained. Instead they got one of the top North Carolina field trialers of all time.

There were eight pups in the litter and only one—Priscilla—would grow up her father's daughter. The rest would favor their mother.

She was the number six pup in the whelp, born in Angie's kitchen. She would become the largest, most striking and stalwart dog in the litter, and from the get go, she had stage presence.

A family friend, Dr. Richard Whitaker, in his late 80s, quickly recognized her potential. An avid bird hunter his entire life, Dr. Whitaker had a passion for pointing dogs. From the start of his long career as a country doctor, he'd load a couple of dogs and hunt his way through the house calls. Once word got around, he was a pushover. Folks knew—they'd send word—if you had birds, Dr. Whitaker would come.

With his son David, he started visiting the puppies regularly, watching them grow. And each time, the number six female would trade both bird wing and littermates for him alone, untying his shoes, licking his face,

***In a field mostly** dominated by pointers, a North Carolina setter—Ida O Priscilla (right)—is bringing back the glory, as well as championships, for her breed in the field trail circuit.*

***Priscilla backs her** sister Ellen as trainer Jimmy Edmundson works both dogs in eastern North Carolina.*

"She had the run in her from day one, but the two things that stood out most were her personality and her character on game."

scampering in and out of his lap. A connection was being established between the pup and the man.

One day while visiting the pups, the elderly physician felt uneasy on his feet, and he fell. With no one immediately at hand, he lay helplessly blowing his whistle for aid. The only one of the litter to care was the number six puppy.

If there was a connection before, there was certainly a tight bond now. Dr. Whitaker took the white pup and a littermate home with him shortly afterward. He named her Priscilla—Ida O Priscilla. She was the fourth of Whitaker's setters to take the name.

Ida O is not a contraction of Idaho, but of Ida Ogburn, Richard Whitaker's mother. "She was a steady, strong, and dependable woman," said son David of his grandmother, " . . .much as Priscilla was proving to be."

Home, hearth and family suited Ida O Priscilla, her disposition readily welcoming companionship. She slept on Dr. Whitaker's bed, David walked her regularly on the streets of downtown Kernersville, and Liza Dick, devout Whitaker family caregiver for 58 years, slipped her biscuits and bacon grease. Charlie and Angie came to visit often.

Even so, seething beneath her even disposition was a restlessness in the dog.

Had anyone given serious thought to her pedigree at that point, the reason would have been apparent. Her blood coursed hot with a genealogical maelstrom of field trial champions, including Ghost Train, Cashmaster, Grouse Ridge John, Will, Sampson, I'm Oscar and Mr. Thor.

As Richard Whitaker's health and mobility continued to decline, David Whitaker became, more and more, the engineer of Priscilla's fate. He had grown up bird hunting in his father's shadow. There were a couple of holdout coveys on the family farm, where he regularly ran Priscilla and her sister Ellen, and once or twice he and Charlie took them to a shooting preserve. Bird crazy, they ignited David's passion anew.

He decided to entrust Priscilla to a local gun dog professional, Clyde McManus, for training.

"She was about a year old," Clyde recollected. "She showed potential and plenty of it. She had the run in her from day one, but the two things that stood out most were her personality and her character on game."

Aside from training, Clyde happened to be active in walking trials, particularly U.S. Complete Shooting Dog stakes. He entered Priscilla into several puppy stakes and won. David was thoroughly enthused.

"David wanted me to run her as a Derby too," Clyde said. "But I'd had her in front of a horse a time or two, and I knew what she could do. She needs to go to horseback stakes, I told him." And he knew exactly who could prepare her for these trials.

Raised in eastern North Carolina in the small town of Warsaw, Jimmy Edmundson "grew up on bird huntin' and Bland's barbecue." After a friend took him to Hoffman for a field trial, he came down with field trialing fever.

"I've always liked setters," he said. "We went to some shooting dog trials and I watched Harold Ray run those setters, and it set me on fire! And it just went from there.

"I started training dogs around home, on my grandmother's land, and on some local farms, compliments of friends."

He gained some wisdom along the way from professionals Wayne Elsberry and Pete Hicks and started going to South Dakota each summer on his own, starting out with a string of shooting dogs and gradually moving to all-age warriors. By 1995, he had been training and trialing publicly for 13 years. Achieving modest success, he had built something as important —an honorable reputation.

He got a call from Kernersville. Could he take on a couple of setters? Both were 2-year-olds, coming "first year dogs." One, he was assured, was particularly capable. Edmundson agreed to take them on.

"They were typical, both Ellen and Priscilla," he

remembered. "I worked 'em a little on pigeons, then took 'em to Dakota in July. They'd do everything immature dogs do—bump, chase, run wild. But Priscilla had a way about her—that easy way of going—nice on game and just a beautiful setter."

In that first summer on prairie chickens and big country, Ida O Priscilla found her niche and began to assert herself. But she wasn't ready yet to win against the hardened veterans of the major-circuit wars. It would take some seasoning. She had the charisma. Did she have the grit?

Back home, Edmundson started running her at Hoffman in the North Carolina Sandhills, "entering her in every major all-age trial on the docket." One time she wouldn't run enough; next she'd be bird-short.

And then all of a sudden the light came on—in one trial. "It was 1997," he recalled. "She figured it all out. She'd stop on that second hill out there and peek back at you and just sail on 'til the birds stopped her! Man, I said to myself. Now what am I gonna do . . . . Now I got to keep up with her."

Less than a year after Jimmy Edmundson laid his eyes on her, she gave him his second championship. Against 58 of the best all-age dogs on the East Coast, she dominated the N.C. Open Quail Championship, scorching the absolute limits of the sandy, serpentine corridors of Hoffman, and giving two scintillating finds to a breathless, hard-riding gallery.

It was only a prelude.

In September 1997, over the immensity of the Madsen Ranch in central South Dakota, she stippled the horizon with an electrifying performance, capturing the runner-up title in the prestigious All-America Prairie Championship. Fifty-one all-age gladiators were bested, including three of the four prairie champions of the season.

Just two months later, she won the Tar Heel Open Championship with 65 contenders. In one of the most stunning all-age exhibitions ever to grace the storied piney woods of Hoffman, Priscilla had so bested the competition that the judges felt it would diminish her performance to name a runner-up.

Two days later, Jimmy Edmundson's corner of the world was pretty bright. "All the top dogs and handlers in the country were there—Robin Gates, Colvin Davis, Freddie Rayl. I felt like I had finally gotten there, that she had finally gotten the recognition she deserved."

Moreover, his celebrity setter was bound for Grand Junction, Tenn., home of the most prestigious field trial in the country. It would be his first encounter with the greatest three hours in field trialing, the very threshold to pointing dog immortality.

It would not be disappointing. At the National Championship in February 1998, Ida O Priscilla wagered a courageous three hours of sterling groundwork and three brilliant finds over a bird-sparse venue, one in each hour, against the reigning champs. Not since its infancy and the immortal trio of Sioux, Geneva and La Besita, has the fair gender, or perhaps any setter since Johnny Crockett in 1970, so closely threatened the coveted title at Grand Junction.

Threatened, not bested. For though many who witnessed her effort that day thought she was the best, the judges saw it differently, naming Cedaroak Kate, a pointer, the winner.

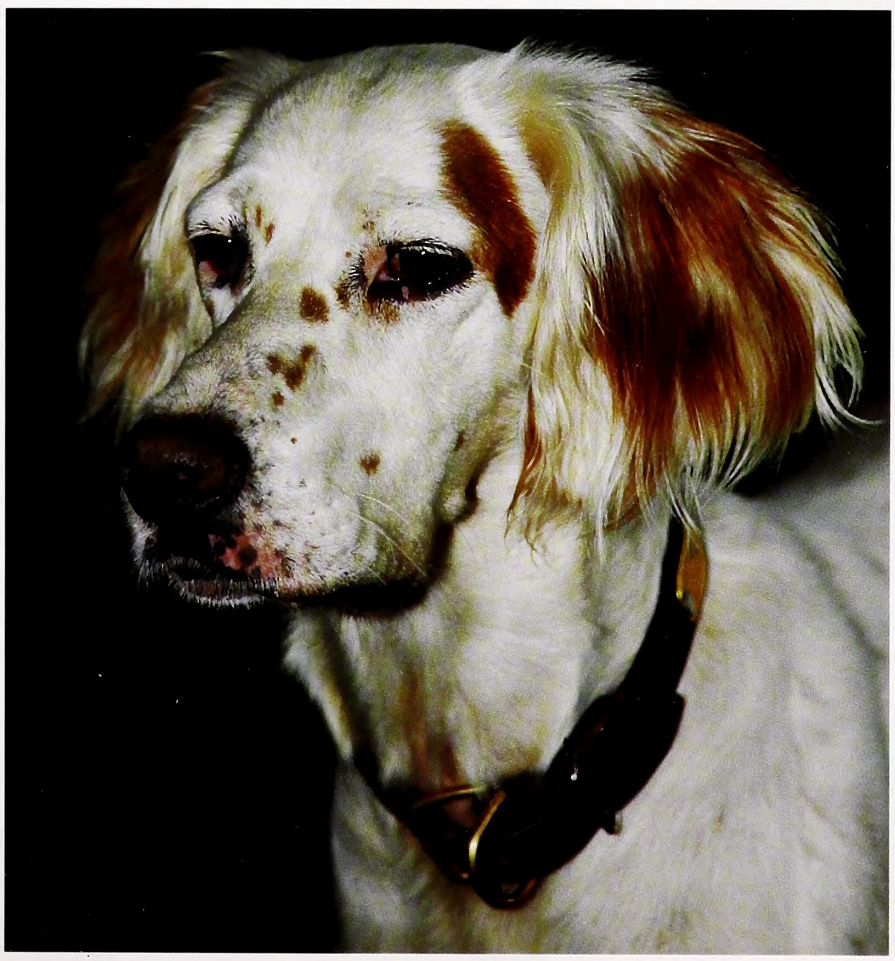
Explaining, Dr. Dorwin E. Hawthorne, one of three judges, had much praise for the setter. "She hunted beautifully and found three coveys with plenty of style (Kate also had three finds). She just didn't quite have the range."

For Priscilla's loyal fans, her success holds little surprise: "From a tiny pup, she had that white-hot intensity, that neverflag ambition," Angie Hall recalls. "She always had places to go."

At age 5, the future is extremely bright for Ida O Priscilla. Her story is hardly complete. With fate on her side, the setter can compete nationally for at least five more years and bring many more titles back home to North Carolina.

The field trial circuit has just wound down for the spring. Come summertime, however, Priscilla will be back home in Kernersville, catching mice with the cat, sporting around in David's new Ford Explorer, escorting Liza home at evening, doting over 91-year-old Dr. Richard Whitaker. And looking forward, perhaps with a gleam in her eye, to taking on the pointers again, and this time outclassing them all. ⊠

"Her story is hardly complete. With fate on her side, the setter can compete nationally for at least five more years and bring many more titles back home to North Carolina."



***By winning the** Tar Heel Open Championship and placing second in the National Championship, Priscilla has already proven she's a top field trial dog.*

When the first European explorers ventured into the wilds of what is now North Carolina, they found a green, fertile land teeming with countless creatures, including cougars, woodland bison, gray and red wolves and elk. Where did those magnificent creatures go?

Ghosts of the Past

written by Ida Phillips Lynch / illustrated by Consie Powell

Native Americans called elk "wapiti," a Shawnee word meaning "white (or pale) deer" referring to its white rump and sides. Unlike white-tailed deer, which often crash noisily through the woods, elk move through open forests almost silently.

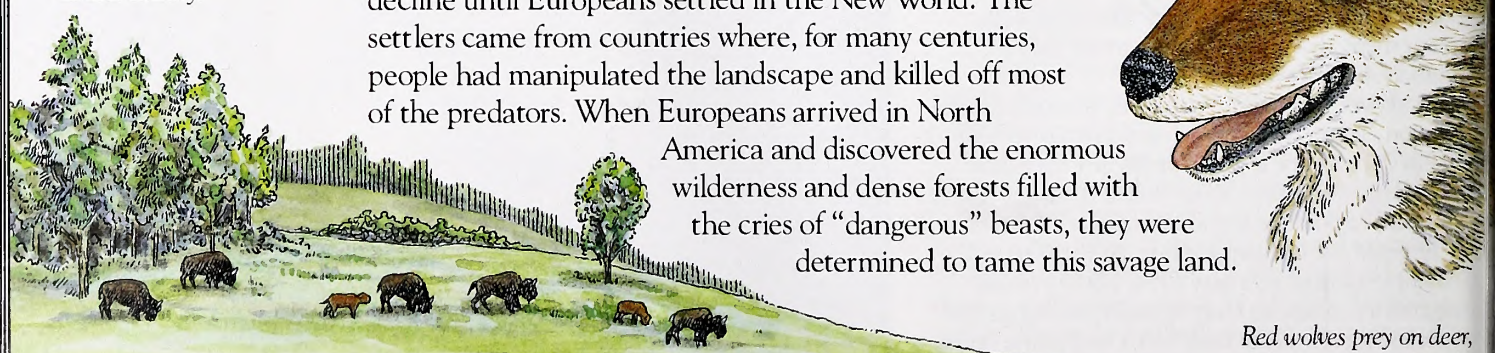
THEY ROAMED WILD AND FREE

Only a few centuries ago, before the arrival of European settlers, large **herbivores** and **carnivores** roamed throughout North America. In the 15th century, an estimated 50 million bison ranged from the Atlantic Ocean almost to the Pacific and from Mexico and Florida into Canada. Elk lived throughout most of the United States and southern Canada. In North Carolina, small herds of eastern woodland bison lived in the Piedmont and Mountain regions, and elk grazed in natural clearings such as **grassy balds** and **Piedmont prairies**. Cougars were found throughout North and South America, gray wolves roamed most of North America, and red wolves inhabited the Southeast from the Atlantic and Gulf coast, north to Pennsylvania, and west to central Texas.

Before the arrival of Europeans, Native Americans hunted the deer, elk and bison. They ate the meat, crafted tools and weapons from the bones and antlers, and used the hides to create robes, moccasins and war shields. Yet, their impact on the populations of large herbivores was minimal.

Elk, bison, cougar and wolf populations did not dramatically decline until Europeans settled in the New World. The settlers came from countries where, for many centuries, people had manipulated the landscape and killed off most of the predators. When Europeans arrived in North America and discovered the enormous wilderness and dense forests filled with the cries of "dangerous" beasts, they were determined to tame this savage land.

Red wolves prey on deer, small mammals and birds.



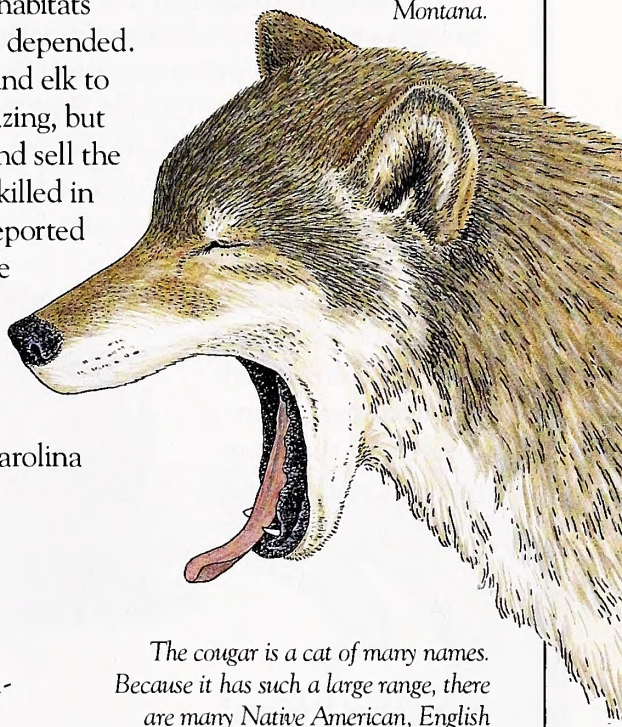
English explorer John Lawson exuberantly described "Buffelo, or wild Beef," panther, wolf and elk as "the Beasts of Carolina" when he wrote one of the earliest natural histories of North Carolina in 1700 and 1701. A later English naturalist, Mark Catesby, wrote in 1731 of elk and bison ranging in "the upper and remote parts of Carolina."

Many Native American tribes depended on bison for food, clothing, shelter and fuel. In the 1800s, the U.S. government initiated a mass extermination of bison as a way of suppressing Native Americans.

TAMING THE SAVAGE LAND

Colonists logged the forests for building materials and cleared land for roads, homes, settlements and farms. Within 200 to 300 years, settlers had destroyed or altered many of the natural habitats upon which native mammals depended. Colonists killed bison and elk to protect crops from grazing, but also to eat the meat and sell the hides. The last bison killed in North Carolina was reported in1769, making bison the first animal that is known to have been **extirpated** from North Carolina in modern times. Elk probably lingered in North Carolina until the mid-1800s.

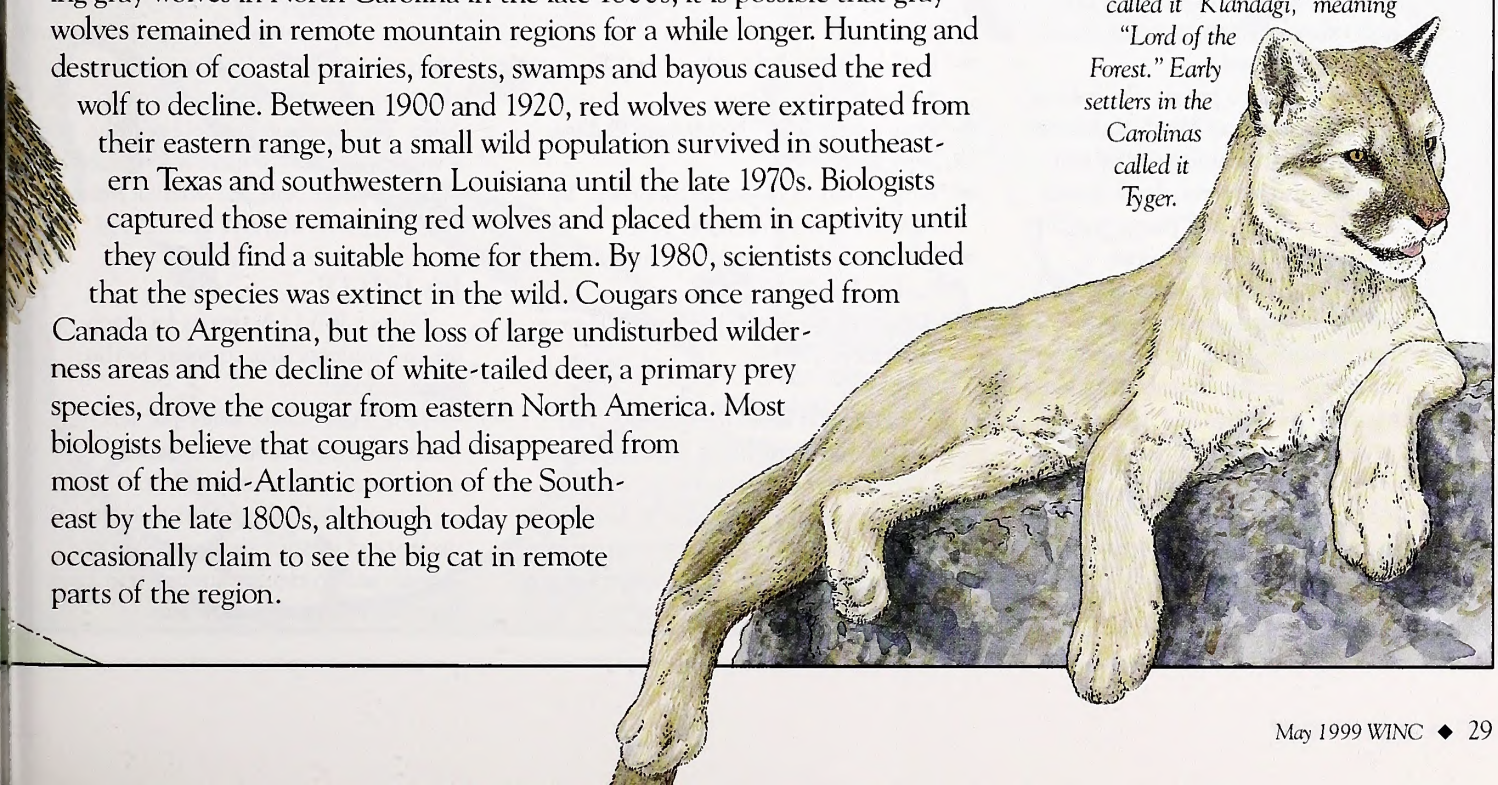
Today gray wolves are found mainly in Alaska and Canada. A sizeable population lives in northern Minnesota and a small population of reintroduced wolves lives in Yellowstone and Glacier National Parks in Wyoming and Montana.



A CONTINUED EXTIRPATION

Throughout history, people have considered carnivores a threat to themselves and their livestock. Colonial settlers systematically hunted, trapped and poisoned predators. Some colonies established a **bounty** on wolves, paying hunters for every wolf they killed. Historical records tell of people killing gray wolves in North Carolina in the late 1800s; it is possible that gray wolves remained in remote mountain regions for a while longer. Hunting and destruction of coastal prairies, forests, swamps and bayous caused the red wolf to decline. Between 1900 and 1920, red wolves were extirpated from their eastern range, but a small wild population survived in southeastern Texas and southwestern Louisiana until the late 1970s. Biologists captured those remaining red wolves and placed them in captivity until they could find a suitable home for them. By 1980, scientists concluded that the species was extinct in the wild. Cougars once ranged from Canada to Argentina, but the loss of large undisturbed wilderness areas and the decline of white-tailed deer, a primary prey species, drove the cougar from eastern North America. Most biologists believe that cougars had disappeared from most of the mid-Atlantic portion of the Southeast by the late 1800s, although today people occasionally claim to see the big cat in remote parts of the region.

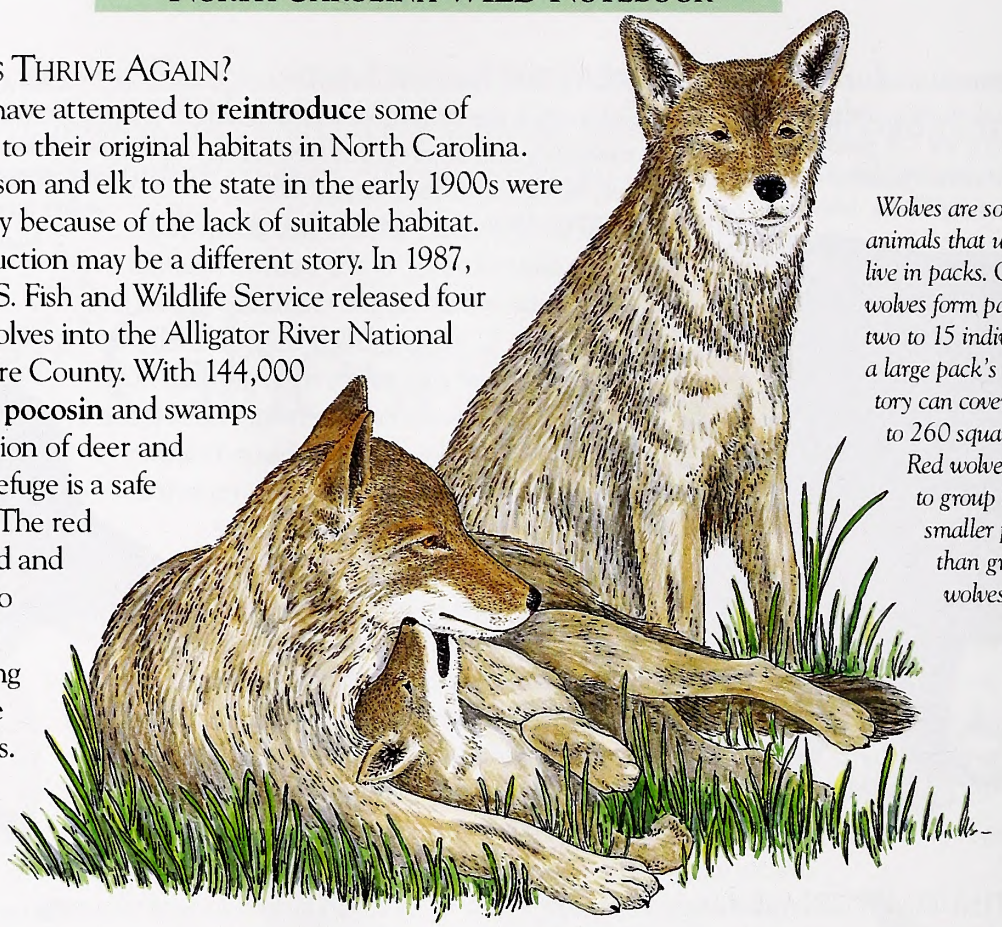
The cougar is a cat of many names. Because it has such a large range, there are many Native American, English and South American names for the elusive cat including mountain lion, puma and panther.The Cherokee called it "Klandagi," meaning "Lord of the Forest." Early settlers in the Carolinas called it Tyger.



WILL THE GHOSTS THRIVE AGAIN?

Wildlife biologists have attempted to **reintroduce** some of these "ghost" species to their original habitats in North Carolina. Reintroductions of bison and elk to the state in the early 1900s were unsuccessful, primarily because of the lack of suitable habitat.

Red wolf reintroduction may be a different story. In 1987, biologists with the U.S. Fish and Wildlife Service released four pairs of captive red wolves into the Alligator River National Wildlife Refuge in Dare County. With 144,000 acres of impenetrable **pocosin** and swamps and a healthy population of deer and small mammals, the refuge is a safe home for the wolves. The red wolves have multiplied and seem to be thriving; to date, between 50 and 100 wolves are roaming throughout the refuge and surrounding lands.



Wolves are social animals that usually live in packs. Gray wolves form packs of two to 15 individuals; a large pack's territory can cover 100 to 260 square miles. Red wolves tend to group in smaller packs than gray wolves.

What Does It Mean?

herbivore: an animal that feeds on plants
carnivore: a flesh-eating animal
grassy bald: an open, largely treeless meadowlike plant community on high ridges or summits in the Southern Appalachians
Piedmont prairie: a prairie-like habitat in the Piedmont of North and South Carolina that contains widely scattered hardwood trees, dense stands of native grasses, and plants typically found in midwestern prairies
extirpate: to eliminate a species from a region within its overall range
bounty: a reward given by a government for killing certain animals considered harmful to humans and livestock
reintroduce: to release an animal into its original habitat in an attempt to help it become reestablished
pocosin: a wetland natural community with thick evergreen shrubs over a peat layer

Read and Find Out

- *New Voyage to Carolina* by John Lawson, University of North Carolina Press, 1984.
- *Wildlife in America* by Peter Matthiessen, Viking Penguin, 1987.

In *Wildlife in North Carolina*

- "Buffalo in North Carolina" by Lawrence S. Earley, June 1996.
- "Born in the Wild" by Michael Phillips, September 1989.
- "John Lawson's Legendary Journey" by Eric G. Bolen, December 1998.
- "Return of the Natives" by Lawrence S. Earley, August 1991.
- "Return of the Red Wolf" by Vic Venters, September 1989.

Websites

- *For information about the U.S. Fish and Wildlife Service Red Wolf Reintroduction Program:* www.fws.gov/r4eao/wildlife
- *For information about the Rocky Mountain Elk Foundation and their efforts to promote a greater understanding and appreciation of elk:* www.remef.org

Get Outside

Listen to red wolves howl in the wild: U.S. Fish and Wildlife Service biologists organize Red Wolf Howling Safaris on the Alligator River National Wildlife Refuge in Dare County. At these special programs, you will learn more about red wolves and have a chance to hear the wolves calling to each other. The howlings are held at night. Send a written request for more information to: Alligator River National Wildlife Refuge, P.O. Box 1969, Manteo, N.C. 27954.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

Here Today, Gone Tomorrow: teaches students to identify some causes for extinctions of animals or plants.

Planting Animals: teaches students to understand reasons for "transplanting" animals and to identify animals that have been transplanted in their area.

North Carolina WILD Notebook

When you travel in North Carolina watch for places named for some of these long-departed creatures. They can give you clues about the animals' original ranges. There are more than 20 "Buffalo Creeks" in the state. More than 70 ridges, branches and creeks contain the word "wolf." You can find creeks, swamps and mountains named for panthers or "painters" as they were sometimes called in the Southern Appalachians.

Editing & design by Consie Powell. Art puzzle by Anne Marshall Runyon

Get WILD

June 13-18 – *Fur, Fish'n Game Rendevous Camp*, week-long outdoor education camp for young people ages 12-15 at Millstone 4-H Center near Ellerbe. Wildlife and fishing opportunities provided. Registration $250. Contact local county Cooperative Extension Service for registration forms or call (919) 515-3244.

Advanced WILD Workshops:

May 15-16 – *Migratory Songbirds*, Cradle of Forestry, Pisgah Forest. Call Cindy Carpenter, (828) 877-3130.

May 22-23 – *Aquatic Ecosystems*, Fayetteville. Call Katrina McDougald, (919) 751-2040. (Advanced Aquatic WILD Workshop)

June 4-5 – *Endangered Species*, SciWorks, Winston-Salem. Call Kelli Johnson, (336) 767-6730.

June 10-11 – *Migratory Songbirds*, Morrow Mountain State Park, Albermarle. Call Mel Porter, (704) 982-1523.

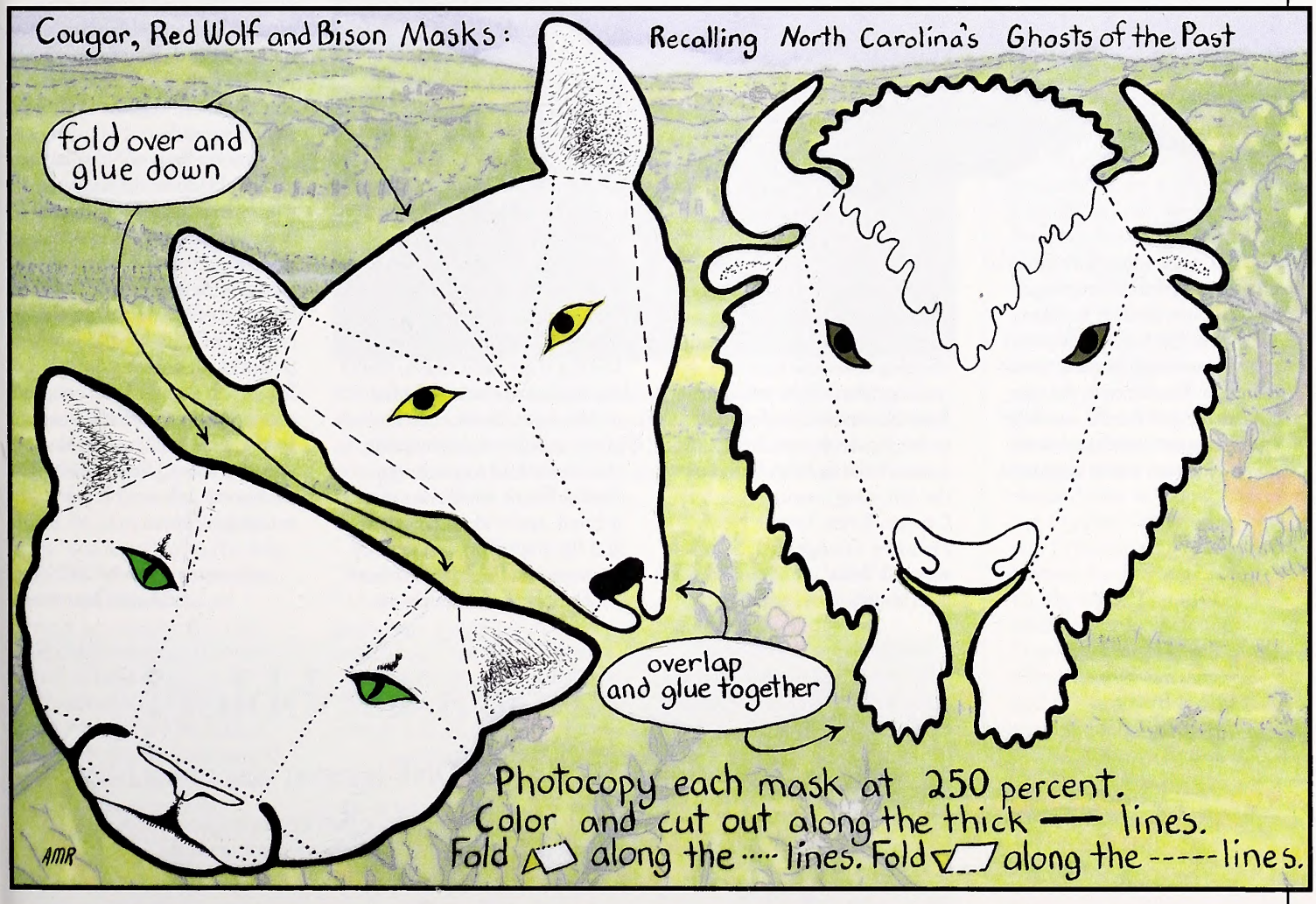
June 16-17 – *Endangered Species*, Fairview Elementary School, Monroe, Call Mel Porter, (704) 982-1523. (Advanced Aquatic WILD Workshop)

June 21-23 – *Mountain Stream Ecology*, Pisgah Center for Wildlife Education, Brevard. Call Program Coodinator, (828) 877-4423. (Advanced Aquatic WILD Workshop)

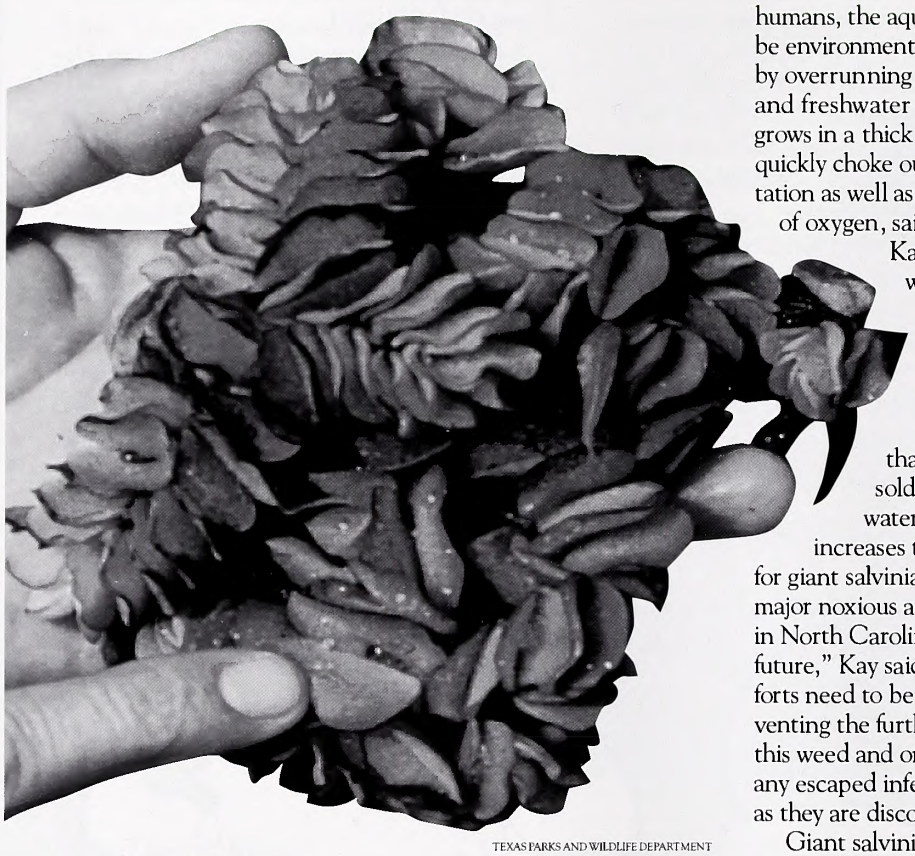
June 28-30 – *Fish Ecology*, New River State Park, Jefferson. Call Todd Ewing, (828) 584-9164. (Advanced N.C. CATCH Workshop)

July 13-16 – *Wildlife Technology*, N.C. Forest Service Training Center, Crossnore. Call Tim Lemon (336) 957-4382.

July 28-29 – *Bats*, Pisgah Center for Wildlife Education, Brevard. Call Program Coordinator, (828) 877-4423.



Harmful Aquatic Weed Discovered in Several North Carolina Counties



TEXAS PARKS AND WILDLIFE DEPARTMENT

***Have you seen this** plant? Environmental officials have posted an all-points bulletin for giant salvinia, which has been found in several counties throughout North Carolina. Not native to the state, the aquatic fern has the capability of quickly overrunning wetlands and choking out native vegetation.*

Officials are urging North Carolina citizens to be on the lookout for a highly invasive aquatic weed that has been discovered at several nurseries and water gardens in North Carolina. Giant salvinia (*Salvinia molesta*), which is prohibited by federal law, has been found in the following counties: Carteret, Craven, Jones, Lenoir, New Hanover, Orange, Pitt, Sampson and Wake.

Though not harmful to humans, the aquatic fern can be environmentally destructive by overrunning coastal swamps and freshwater wetlands. It grows in a thick mat and can quickly choke out native vegetation as well as deplete water of oxygen, said Stratford Kay, an aquatic weed management specialist with N.C. State University.

"The fact that it has been sold openly as a water garden plant increases the potential for giant salvinia to become a major noxious aquatic weed in North Carolina in the near future," Kay said. "Serious efforts need to be focused on preventing the further spread of this weed and on eliminating any escaped infestations as soon as they are discovered."

Giant salvinia, also referred to as Kariba weed, aquarium watermoss or African pyle, is an aquatic fern native to Brazil. It has floating, oblong leaves one-half to 1½ inches in length. During their early stages, plants are smaller and leaves lie flat on the water surface. As the plants mature and form mats, the leaves fold into upright chains. Giant salvinia can readily break apart when handled, and the fragments can develop into new infestations elsewhere.

The plant can double its growth in only a few days during warm weather, and may pile up into mats as much as 2 feet thick. In only one year, giant salvinia has caused serious problems in Texas and northwestern Louisiana.

The discovery of this weed has prompted North Carolina officials to stop sales to all nurseries and plant dealers. Once discovered, the plants should be destroyed. *Salvinia molesta* has not been spotted in any natural water body or flowing stream.

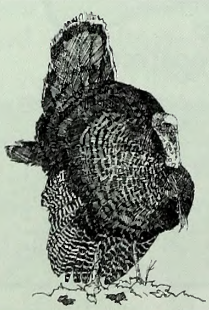
Though the species is not yet considered naturalized, there is a significant probability that it could be in the near future. This could have a devastating impact on freshwater habitats needed by fish and wildlife in the Coastal Plain and Piedmont regions of the state, Kay said.

Any findings of *Salvinia molesta* should be reported immediately to one of the following organizations: N.C. Department of Agriculture & Consumer Services (919) 733-6932; N.C. Division of Water Resources (919) 715-0389; NCSU Crop Sciences Department (919) 515-5645; or your local county cooperative extension service.

For additional information, visit the United States Geological Survey website (http://nas.er.usgs.gov/ferns).

—Courtesy of the NCSU Crop Sciences Department

Edited by Chris Powell



Got a Gobbler?

Call 1-800-I-GOT-ONE to report your turkey harvest.

**All bearded birds harvested during the 1999 turkey season must be reported either through a cooperator agent or via the toll-free telephone reporting system.*

Migratory Bird Lovers Get Wake-up Call

New findings suggest that changes in the way coffee is being grown in Latin America and the Caribbean may be contributing to the decline of many of North Carolina's favorite migratory songbirds.

Scientists have suspected that the loss of natural forests in North America and in the tropics was the major reason some migratory bird species were declining. It now appears that the disappearance of traditional coffee plantations in Latin America is also threatening songbirds. Bird surveys done in the early 1990s discovered wide use of shade coffee plantations by a variety of North Carolina summer birds such as indigo buntings, ovenbirds, black-throated blue warblers, American redstarts and golden-winged warblers.

These birds nest in temperate North America each summer; then, in the fall, they fly south to winter in Mexico, Central America and the Caribbean. However, the wintering grounds of many of our most well-known neotropical migrant birds have been replaced with agricultural fields during the last 20 years. Because of this, some birds have increasingly sought refuge in traditional coffee plantations where coffee plants are grown under a canopy of trees that provides shade. In some areas of this region, "shade coffee" is the only forestlike habitat that remains.

Many Latin American farmers are switching to high-yield coffee varieties that are grown in full sunlight. As of 1990, about half of northern Latin America's 5.94 million acres of coffee plantations had already been converted from shade to sun plantations.

Migratory songbirds face other serious problems along migration routes and in their North American breeding grounds.

N.C. WILDLIFE RESOURCES COMMISSION

Ornothologists are urging bird lovers *to purchase coffee grown in shaded Latin American plantations. By supporting this "old style" method of coffee farming, bird lovers can help provide critical habitat needed for neotropical migratory birds such as this wood thrush (above), which temporarily calls North Carolina home.*

These include habitat fragmentation and predation by human-associated animals such as cats, raccoons, crows and squirrels. The complicated life cycles of these birds make conservation efforts difficult, at best.

To promote habitat for these migratory birds, wildlife professionals are recommending the purchase of coffee blends grown using shaded methods. For example, bird-friendly roasts can be found at the Counter Culture Coffee store, located in Durham. Call (888) 238-5282 for ordering information.

These blends are touted as being far superior to most sun-grown, store brands, and buying them supports a market for shade grown varieties of coffee. So raise a cup of shade-grown coffee for the birds each morning.

—Mark Johns, N.C. Partners in Flight coordinator for the Wildlife Commission

On Patrol

Editor's note: *While most North Carolina sportsmen are law-abiding, a few are not. Listed below is a report of a wildlife violation that exemplifies some of the humorous, and at times bizarre, situations our North Carolina wildlife enforcement officers encounter while on patrol.*

While working the Cape Fear River, wildlife officers encountered some men in a campsite that contained a barrel of live bluegills and a supply of jugs and hooks. The officers explained the law regarding the use of live bait with set hooks (unattended terminal tackle extending from a free-floating device). The men said they understood and didn't want any trouble.

After dark, the officers returned to the river and found a jug with live bait floating about 50 yards from the campsite. While the officers were checking it, one of the men at the campsite hollered that it was their jug and whoever was out there should leave it alone. The officers continued to check the remaining jugs, so the suspects decided they would motor out to protect their property from the would-be thieves. As they approached, the officers brought their vessel alongside the boat. After an awkward silence, one of the men said to the other, "It's the game warden, man."

Field Notes

Wild Turkey (bearded birds only)—Through May 8

Hatchery Supported Trout Waters—Open

Wild Trout Waters—Year-round

Delayed Harvest Trout Waters —Through June 4 (catch-and-release)

Information on bag limits and other regulations may be found in the *1998-99 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest*. For a copy, check with license agents or contact the N.C. Wildlife Resources Commission. at 1-800-675-0263.

NORTH CAROLINA Wildlife RESOURCES COMMISSION

Federation Honors Commissioner, Officers and Educator

A N.C. Wildlife Resources Commissioner was recently inducted by the N.C. Wildlife Federation into its Conservation Hall of Fame.

John Lentz, of Ellerbe, was honored at the Governor's Conservation Achievement Awards banquet, held in the Research Triangle Park. Lentz has been a member of the Wildlife Resources Commission for nine years and served as chairman for four of those years. In addition, he was president of the Wildlife Federation in 1981 and served as a Federation director for 10 years. He was also instrumental in organizing the Richmond County chapters of Ducks Unlimited and Quail Unlimited. Lentz is the 21st person ever to be inducted.

STEVE WILSON

A N.C. Wildlife Resources Commissioner, *two Wildlife Commission employees and a private contributor were a few of the folks recently honored by the N.C. Wildlife Federation at the Governor's Conservation Achievement Awards Banquet. Among those receiving awards were: Wildlife Commission field supervisor Celeste Wescott Maus (first row, third from left), Wildlife Enforcement Sgt. John Massey (first row, fourth from left), Fayetteville resident Dohn Broadwell (second row, third from left), and Wildlife Commissioner John Lentz, (second row, far right).*

The Wildlife Federation also honored John Massey, a sergeant with the enforcement division of the N.C. Wildlife Resources Commission, as the Wildlife Officer of the Year.

A 21-year veteran with the Wildlife Commission, Massey supervises Alamance, Orange and Caswell counties. During 1998, his patrol area led the district in detecting turkey violations, total hunting arrests and cases involving people operating boats while impaired. In addition, officers in his patrol area detected a large number of night-boating and waterfowl violations.

Massey, who lives in Burlington, attributed the award to the fellow officers he supervises in his patrol area. "I share this award with wildlife officers Todd Kennedy, Cam Ingram and Barry Joyce," Massey said, after the ceremony. "Everything we do is a team effort."

Also named by the Wildlife Federation as officers of the year for their respective wildlife districts were: W. Tony Pennell, Ahoskie; Christopher Huebner, Newport; James M. Ward, Roanoke Rapids; Timothy O. Hardy, Erwin; Gary W. Caulk, Seven Lakes; Russell W. Hunter IV, Boonville; B. Scott Loflin, Lincolnton; and Vance Gibson, Tuckasagee.

The Wildlife Federation also honored Dohn Broadwell of Fayetteville by naming him Conservationist of the Year for his part in helping the Wildlife Commission and The Nature Conservancy purchase the Horseshoe Lake Natural Area, located in Bladen and Cumberland counties.

Working with The Nature Conservancy, the Wildlife Commission was able to raise $3.7 million in public funding to purchase 8,000 acres. However, when the Wildlife Commission fell short in its funding to buy the entire tract, Broadwell provided more than $1 million of his own money to secure the remaining 1,915 acres.

Celeste Wescott Maus, a field supervisor and coordinator for the Wildlife Commission's Education Division, was named Environmental Educator of the Year.

Wescott Maus coordinates the N.C. WILD and N.C. CATCH programs. In addition she has supervised the Wildlife Commission's Natural Resources Science Fair Awards, helped develop the state certification program for environmental education and was a member of the International Project WILD program committee. In 1996, she was chosen as the U.S. Project WILD Coordinator of the Year.

NORTH CAROLINA WILDLIFE FEDERATION 19 45 ENVIRONMENTAL QUALITY

North Carolina Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

May 8

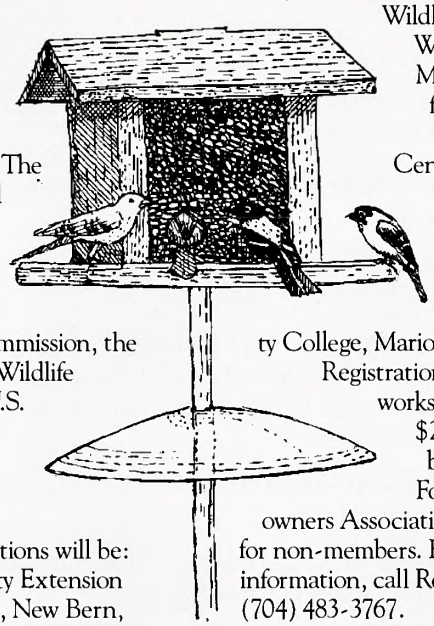
The Pisgah Center for Wildlife Education, located near Brevard, will conduct the program entitled "That's for the Birds" from 1:30 to 4 p.m. Participants can celebrate Migratory Bird Day by building birdhouses and feeders. Materials will be provided. The workshop is limited to 10 participants. For more information, call (828) 877-4423.

May 17, May 19-21

The N.C. Museum of Natural Sciences will host Museum Week from 11 a.m. to 2 p.m. Come for lunch and meet the animals. Each day, you'll come face to face with live animals from around the world. Meet a chinchilla from the Andes Mountains, a ball python from equatorial West Africa and a corn snake from North Carolina. For more information, call Karen Kemp at (919) 733-7450.

May 24-27

A series of four workshops, sponsored by the Forest Landowners Association, will be conducted at different locations throughout the state. Held from 3 to 6:30 p.m., the presentations will cover wildlife subjects ranging from game management to drafting a hunting lease. The workshops will be conducted by specialists from the N.C. Wildlife Resources Commission, the U.S. Fish and Wildlife Service, the U.S. Forest Service and private wildlife organizations. The workshop locations will be: Craven County Extension Service Office, New Bern, May 24; Pee Dee National Wildlife Refuge, Wadesboro, May 25; Guilford County Extension Center, Greensboro, May 26; and McDowell Technical Community College, Marion, May 27. Registration for the workshops will be $20 for members of the Forest Landowners Association and $30 for non-members. For further information, call Ron Bost at (704) 483-3767.

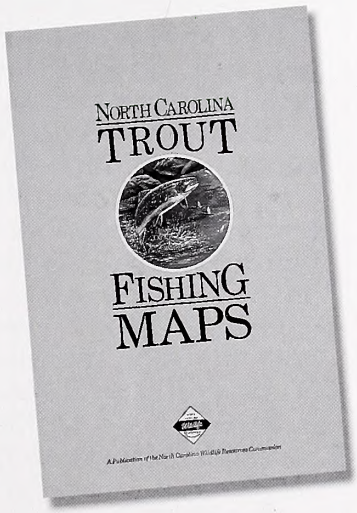


North Carolina Trout Fishing Maps Helps Anglers Find Better Fishing

With mountain trout season underway and thousands of miles of varied streams to choose from, most Tar Heel anglers must first decide where to go fishing. A copy of the N.C. Wildlife Resources Commission's trout stream booklet should help anglers make more informed decisions no matter what sort of stream they want to fish.

North Carolina Trout Fishing Maps is the first publication to show all of the state's designated public mountain trout waters. Covering more than 2,100 miles of streams in 25 western counties, maps of each county containing trout streams managed by the Wildlife Commission are presented in a large atlas format. Streams are color-coded to reflect the specific regulations in effect for that stream, and colors match those on signs that are placed at various locations along each waterway.

Each map also depicts game land boundaries, federal lands, state parks as well as major roads and towns. Besides detailing license requirements for fishing in North Carolina's public trout waters, the booklet lists 10 streams and lakes with universal access for disabled anglers. Each entry includes directions to the universal access area and lists improvements—piers, platforms and paved paths—that give disabled citizens a chance at wild and stocked trout.



The Wildlife Commission charges $12 for the map book to cover production costs. Trout map books are available at various outfitters and tackle shops across the state. They are also available at the Wildlife Commission's Pisgah Center for Wildlife Education, near Brevard. To order the map books directly from the Wildlife Commission, use the form below.

Trout Map Book, P.O. Box 29607, Raleigh, N.C. 27626-0607
(Office is located at 322 Chapanoke Road in Raleigh, (919) 662-4377.)

Please send me _____ N.C. Trout Map Books at $12.00 each .$_____

All N.C. residents add $.72 sales tax per map book ..... _____

☐ Enclosed is my check for **total** payment of .....$_____

☐ Charge to MasterCard or VISA for the map book(s) ordered above. My card number is _____ and the expiration date is _____/_____.

_____ (_____)_____
Card holder signature | Day Time Phone No.

Name _____

Address _____

City/State/Zip_____

Phone (_____) _____

Make checks payable to: N.C. Wildlife Resources Commission. All orders must be prepaid. We do not bill. Please do not send cash. Allow 4 weeks for delivery. A $20 charge will be made on returned checks (N.C.G.S. 25-3-512).

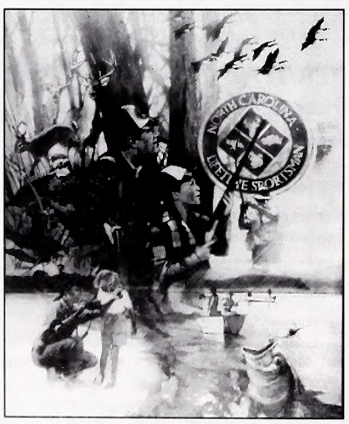
Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report



Totals Through February 1999

Principal Balance
$27,524,948.63

Interest Earned
$27,453,076.41

Total Receipts
$54,978,025.04

Interest Used
$15,250,446.04

Fund Balance
$39,727,579.00

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.

Cats and Trout

by Rodney Foushee

Keeping Cats Indoors: Each year hundreds of millions of wild birds and small mammals are killed by free-roaming house cats in the United States. Millions of pet cats, meanwhile, are killed by cars, dogs and other outdoor hazards. Though we can't change a cat's instinct to hunt, cat owners can stop the carnage by simply keeping their cats indoors.

That's the message of a national campaign designed to reduce the unnecessary loss of wildlife and pets. The Humane Society and the American Humane Association have teamed up with the American Bird Conservancy to promote "Cats Indoors! The Campaign for Safer Birds and Cats."

Besides keeping your cats indoors at all times, it's also important to neuter them at an early age to reduce their tendency to roam and eliminate unwanted kittens. You can provide your cat with an alternative to free roaming such as a screened porch. An indoor window shelf will also allow your cat to monitor the outdoors from the safety of your home.

For more information about the Cat's Indoors! campaign, call (202) 778-9666. Or check out the American Bird Conservancy's web page at http://www.abcbirds.org/.

Mountain Pond Stocking: Spring is an excellent time to stock private ponds in the North Carolina mountains. However, stocking with a fish species without knowing if it is appropriate for the local area can lead to disaster. A fish kill can result either immediately or in the future without an understanding of specific pond and species requirements.

Most pond owners in western North Carolina prefer rainbow trout, but trout are often not appropriate for mountain ponds. Water temperatures exceeding 70 degrees F can easily kill rainbow trout. This is common in many mountain ponds with low water flow during the summer. An understanding of your pond's summer water temperature and flow is critical to successful fish stocking.

In ponds that exceed 70 degrees, two options are available. Rainbow trout can be stocked in the fall when temperatures are low and then harvested the following spring before the water gets too warm.

A second option is to stock your ponds with warmwater species including largemouth bass, bluegills and catfish. These species prefer water temperatures between 70 and 80 degrees.

For more information on stocking mountain ponds including stocking rates and fingerling suppliers, call Extension Service specialist Skip Thompson at (828) 456-3575.

N.C. WILD STORE

NEW!

Introducing the second poster in our "Sporting Heritage" series...

TRADITIONAL TROUT FLIES OF THE SOUTHERN APPALACHIANS

Sixteen traditional trout flies are presented in stunning color detail. This high-quality, framable poster is destined to become a showpiece and reference for trout anglers across North Carolina and beyond. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. $10. ITEM CODE P13

★★★★★★★★★★★★★★

COMING SOON!

Look for the second poster in our colorful "Frogs of North Carolina" series. (See page 38 for the first in the series.)

TRADITIONAL TROUT FLIES of THE SOUTHERN APPALACHIANS

North Carolina's Heritage SPORTING

The Southern Appalachians have spawned a surprisingly rich legacy of proven trout fly patterns, some developed locally and some adapted from elsewhere. The earliest fly fishers here may have been the Cherokees who, when hooks became available to them, are thought to have wrapped narrow strips of deer hide on hooks, leaving the hair attached to fashion a fly-like lure. Most traditional favorite flies are attractor type patterns that do not imitate a specific aquatic insect. This is because our streams are small and not particularly rich, and the trout tend to feed opportunistically on a wide variety of foods. Most of these patterns are also dry flies that are highly buoyant and easy to see. Should you decide to test them on the water, you will surely discover why they have endured as handsome evidence of our trout fishing heritage.

YALLERHAMMER WET FLY

This very old pattern is one of the first developed in the Southern Appalachians. It was originally tied using split primary wing quills of the yellow-shafted flicker (yellowhammer) that were soaked in water, wrapped around the hook and trimmed. It was fished as a dry or wet fly, but more often as a trailer behind a spinner blade. Since these stool perches are now protected, the pattern is closely duplicated with legal materials.

Tail: dyed grizzly yellow hackle barbs; **body:** peacock herl over yellow floss or fur; **hackle:** grizzly dyed yellow, clipped.

SMOKY MOUNTAIN FORKTAIL

Though its origin is unknown, this old regional dry fly pattern received national exposure when well-known outdoor writer Ray Bergman described it in the late 1930s. Several variations of this somewhat fragile, but effective, pattern exist.

Tail: gray goose biot; **body:** red fox fur; **hackle:** mixed grizzly and brown; **wing:** goose biots or gray primary duck wing, tied spent.

YELLOW MAY

Though hatches are sparse in Southern Appalachian streams, quite a few light-colored mayflies hatch in the spring. This old pattern—nearly identical, except for body color, to the traditional light Cahill of northeastern origin—has been a spring favorite in our waters for many years.

Tail: wood duck flank or light ginger hackle barbs; **body:** light yellow spun floss or fur; **wing:** wood duck flank; **hackle:** light ginger.

HAZEL CREEK

Though its originator is unknown, this old dry fly pattern has long been popular on trout streams in the Great Smoky Mountains National Park, and is named for one of those streams.

Tail: golden pheasant tippets; **body:** cream fur; **wing:** white hackle tips; **hackle:** brown and grizzly mixed.

GRAY HACKLE

A widely used early dry fly pattern that became popular in the Southern Appalachians because it was effective and could be tied with only a few, readily available, materials.

Tail: red hackle barbs; **body:** yellow floss; **rib:** silver tinsel; **wing:** teal flank; **hackle:** grizzly.

COREY'S CALF TAIL

Originally devised in Michigan as a large night fishing pattern, it has been downsized for use as a very buoyant dry fly for swift Southern Appalachian streams. It is particularly favored by anglers fishing Catalochee and Big creeks in the eastern end of the Great Smoky Mountains National Park.

Tail: calf tail; **rib:** palmered brown and grizzly; **body:** yellow fur; **wing:** calf tail; **hackle:** brown.

FEMALE ADAMS

The Adams is an old, widely used pattern developed in the Northeast, and the Female Adams with the addition of the yellow egg sac has been a regional favorite in the Southern Appalachians for many years.

Tail: golden pheasant tippets or brown hackle barbs; **egg sac:** yellow floss, fine yellow chenille or yellow ostrich herl; **body:** muskrat; **wing:** grizzly hackle tips; **hackle:** brown and grizzly mixed.

ADAMS VARIANT

This Southern Appalachian classic dry fly was developed by the late Fred Hall and, like many regional favorites, is a highly visible and buoyant pattern that is not designed to duplicate any specific insect.

Tail: golden pheasant tippets (or deer hair); **rear hackle:** grizzly; **body:** yellow ostrich herl; **wings:** grizzly hackle tips; **front hackle:** grizzly and brown mixed.

THUNDERHEAD

This bug-and-fly originated in the western states; however, the late Fred Hall is often credited with its creation because he is thought to be the first to use it in the Smokies where it is still popular.

Tail: brown hackle barbs or muskrat guard hairs; **body:** muskrat with guard hairs; **wings:** white calftail; **hackle:** brown.

YELLOW PALMER

This fly is very similar to the "yallerhammer" pattern. Flies with palmered hackles (hackle wrapped the length of the body) are centuries old, dating back to Europe, and this style of fly continues to enjoy special favor in the swift waters of the Southern Appalachians because it floats well, the angler can see it and materials are simple and readily available.

Tail: brown and grizzly hackle barbs; **body:** medium yellow fur; **hackle:** brown and grizzly; **thread:** yellow.

RATTLER

This is an old pattern that is thought to have been first tied for use in late winter or early spring on the Oconaluftee River. With its palmered hackle body, it is buoyant and highly visible.

Tail: golden pheasant tippets; **body:** brown and grizzly mixed; **hackle:** brown and grizzly mixed; **wing:** calf tail.

EARLY NELSON

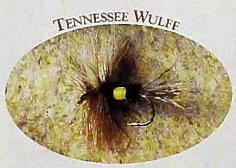
This fly was originated by the late Cap Wyse who was head master at Patterson School in Caldwell County and who taught many youngsters how to fly fish. The peacock herl body is particularly attractive to trout.

Tail: black bear hair; **body:** peacock herl; **wing:** grizzly hackle tips; **hackle:** brown and grizzly mixed.

ROYAL WULFF

Originated by the late Lee Wulff, this buoyant and highly visible dry fly is arguably one of the most popular throughout the country, and it has become a particular favorite in the Southern Appalachians. Some fishermen say they seldom use any other dry fly.

Tail: deer hair; **body:** center of red floss flanked by peacock herl; **wing:** white calf tail; **hackle:** brown.



TENNESSEE WULFF

This dry fly has become increasingly popular on Southern Appalachian streams in recent years. It is identical to the Royal Wulff except that the center body hair is green instead of red, and the tail and hackle are sometimes darker brown.

Tail: deer hair; **body:** center of green floss flanked by peacock herl; **wing:** white calf tail; **hackle:** brown.

TELLICO NYMPH

This pattern originated in Tennessee and has long been one of the most popular nymph patterns in the Southeast, even gaining popularity elsewhere. It is thought to imitate a stonefly nymph, some of which have yellow bodies.

Tail: golden pheasant tippets or brown hackle barbs; **body:** yellow chenille or fur; **rib:** peacock herl; **overlay:** brown turkey wing; **hackle:** brown.

COFFEY'S STONE NYMPH

Although traditional nymph patterns are fairly uncommon in the Southern Appalachians, fishing with nymph patterns can be highly productive and has become more popular in recent years. This pattern was originated by the late Frank Coffey of Haywood County.

Tail: gray goose biots; **body:** brown furry; **feelers:** gray goose biots.

Flies by Roger Dunn. Written by Jim Dean. Photographed by Melissa McClure. Designed and published by Division of Conservation Education, N.C. Wildlife Resources Commission.

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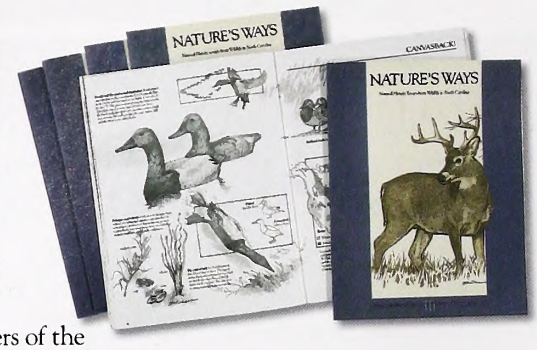

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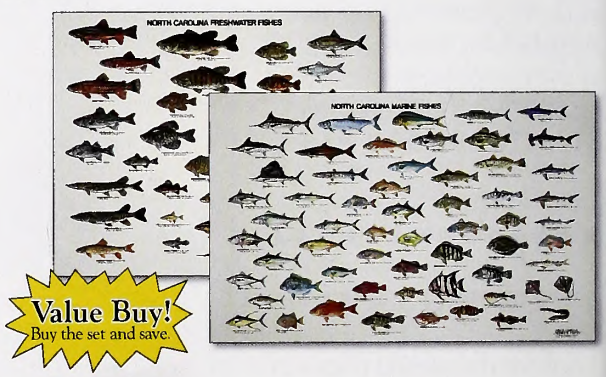

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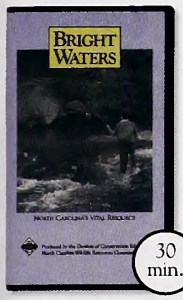

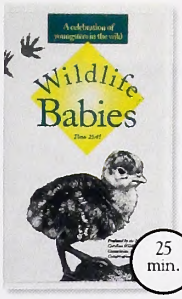

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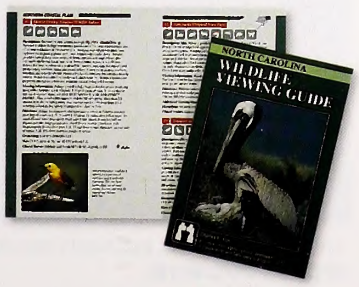

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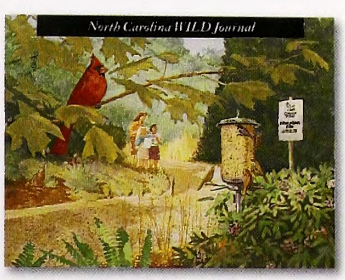

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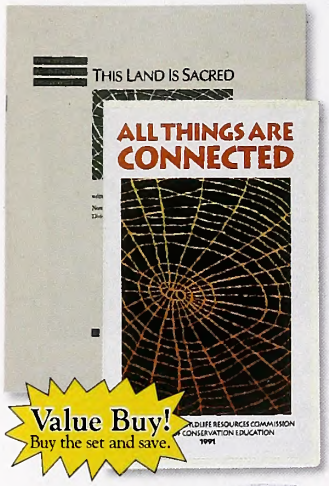

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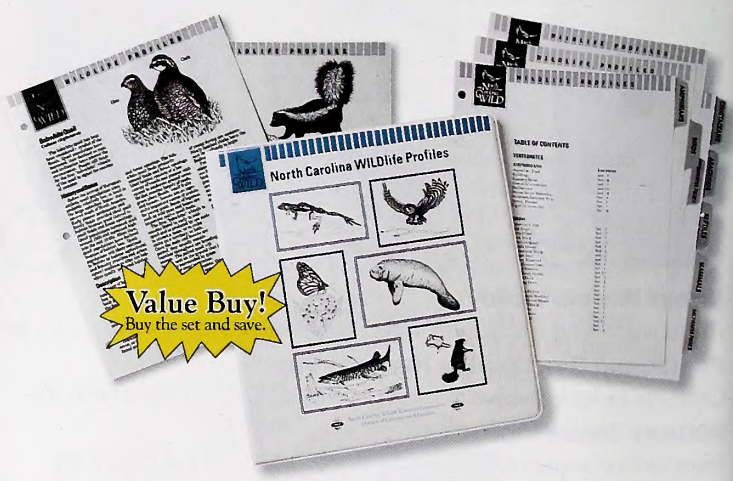

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WILDLIFE COMMISSION

SPOTLIGHT

Becoming an Outdoors Woman

Attention all women! Have you ever wanted to learn or improve your outdoor skills in a fun, non-threatening atmosphere? Now you have the chance through the N.C. Wildlife Resources Commission's popular Becoming an Outdoors Woman (BOW) Program.

Part of a national program to break down the barriers that have historically prevented women from enjoying outdoor activities, participants are exposed to a variety of activities through a three-day workshop.

This year's North Carolina workshop is set for Oct. 1-3 at Camp Seagull on the lower Neuse River. And the key word is FUN! Whether you're interested in canoeing, sailing, rifle marksmanship, flyfishing, archery or outdoor photography, there's a class just for you.

But hurry and sign up now because the BOW workshop is limited to the first 100 women ages 18 and up. At a cost of $175 including all meals and lodging, the workshop is a bargain. Of course, the camaraderie and friendships you'll gain are absolutely free! For more information or to register, call BOW Coordinator Cheryl West at (919) 733-7123 Ext. 269.

photographs by Ken Taylor

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Thompson Falls is only one of dozens of spectacular waterfalls in the Jocassee Gorges area in southwestern North Carolina. The area has the greatest concentration of waterfalls on the East Coast.

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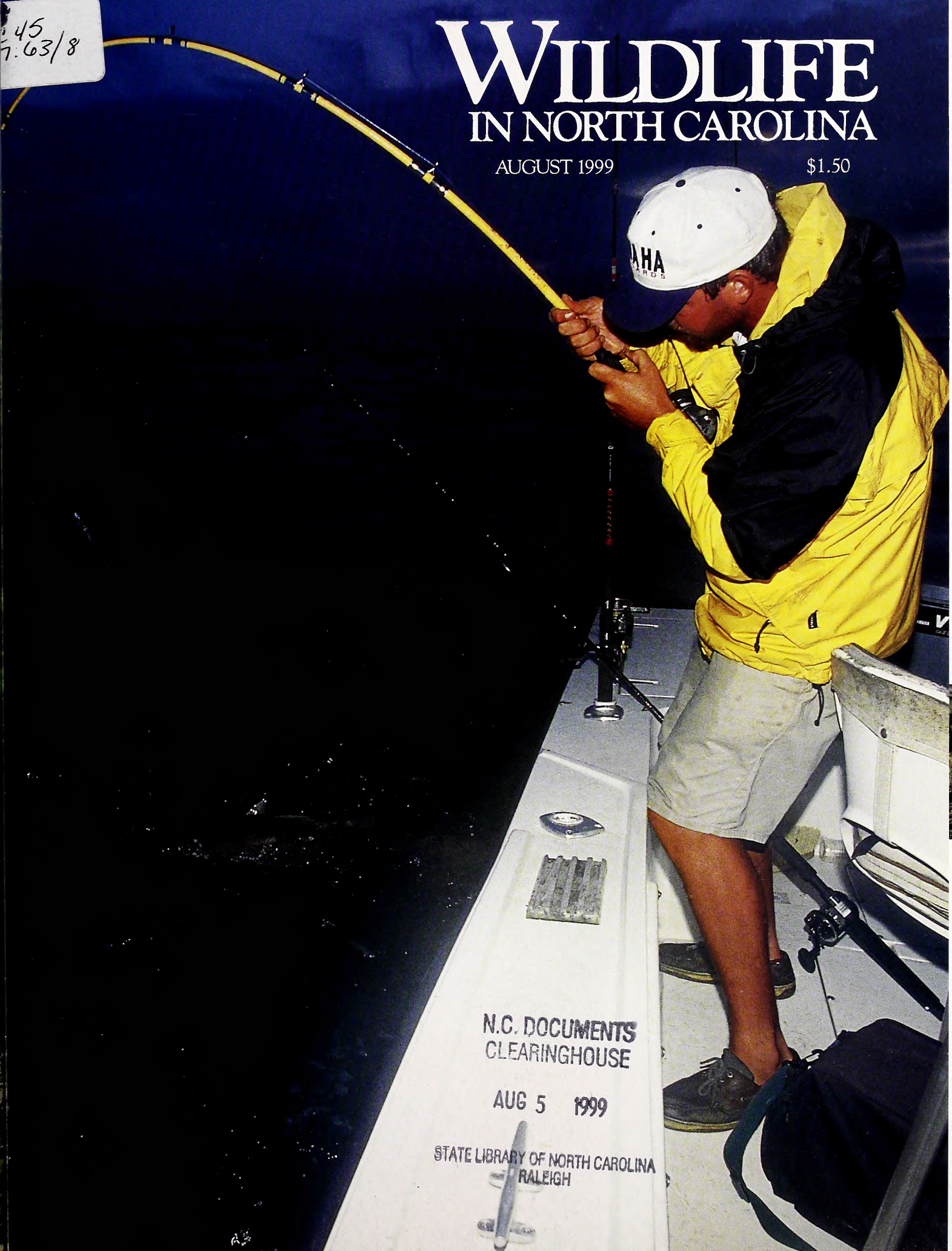

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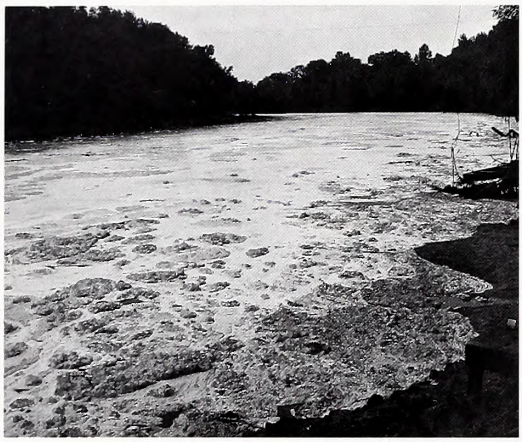
The Roanoke Remembered

by Jim Dean ©1999

If you are looking for a lesson that documents the eventual fruits of persistence, common sense economics, applied biology, sound environmental stewardship—and a bit of good luck—you could hardly find a better one than the present state of the Roanoke River.

When I was growing up in Halifax County in the 1940s, this river—though eternally muddy and reeking with pollution—was the lifeblood of the region. Local businesses often closed during the peak of the rockfish spawning run each spring (we didn't call them striped bass then; didn't even know they were the same fish). For weeks, the river would be covered with bow-netters and sport fishermen. At Weldon, you often had to step through a dozen or more boats strung on cables halfway across the river to reach your own boat. Technicians at the N.C. Wildlife Resources Commission's hatchery—in operation seasonally since the mid-1800s—were still stripping eggs from ripe females and releasing the fry in the hope that this enhanced the run.



WILLIAM ESMOND CARTER

The Roanoke also provided water and served as a waste disposal for the big pulp and paper mills just upstream at Roanoke Rapids, furnishing year-round employment for many. We complained about the smell, the stupefying pollution and the spring floods that occurred with such regularity. Yet, the rockfish runs were remarkably robust.

Then came the dams. While the flooding had enriched flood-prone bottomlands, it had also played havoc along the lower Roanoke (plantation homes downstream were built 8 feet off the ground on pillars). In 1953, Kerr Lake was impounded, followed by Roanoke Rapids Lake in 1955. In 1963 Gaston, lying between the two, completed the string and the river's floods were brought under control.

"The pollution was incredibly awful. The river was frequently covered from bank to bank with thick, brownish-white foam."

When the rockfish runs began to decline, the dams seemed at first to be an unlikely factor. People were quicker to blame the paper mill's pollution—and, some years later, the Wildlife Commission's decision to close the hatchery. Certainly, those were more obvious targets. The pollution was incredibly awful. The river was frequently covered from bank to bank with thick, brownish-white foam. Bacteria that fed on the sugar from the mill's effluent fouled fishing lines with ropes of brown slime. And these were only the visible pollutants. But the pollution had been there a long time, even during periods when the fishery had seemed more stable.

As for the hatchery, there had never been any concrete evidence that released fry played any significant role. Indeed, the number of fry released each year was a drop in the bucket compared to natural spawning. Fishery biologists, however, strongly suspected that the water levels were playing a very critical role in this deadly mix—that the flooding had not only diluted the wastes, but also met the stripers' ideal spawning needs frequently enough to sustain a large population in spite of other problems. Yet, proof was hard to come by and the U. S. Army Corps of Engineers was at first reluctant to maintain ideal flows during the peak of the spawning season.

Then, over the years, things began to change. The paper mills built lagoons to settle out some of the more visible waste and changed other procedures to decrease pollution. The foam and bacteria were substantially reduced. With silt now settling out in the upstream lakes, the water in the river became remarkably clear. Commercial netting was outlawed, and regulations that limited the harvest by sport fishermen were adopted—stripers could be kept under strict size-and-creel limits only until a certain poundage had been reached each year, and then all had to be released. And, perhaps most important, the long-sought concept of maintaining seasonal flows favorable to spawning was finally adopted.

It has taken nearly 50 years to sort it all out, but during the past decade the striped bass population has rebounded beyond all expectations. As a bonus, a strong hickory shad fishery has developed, astonishing fishermen who had never seen these fish in the upper Roanoke.

Weldon still sits astride the famous spawning grounds of the stripers, and it has a better claim to call itself "The Rockfish Capital of the World" than ever. Nowadays, fishermen come from everywhere to cast jigs and even topwater lures (back in those good ol' days, we were virtually restricted to catching fish on bloodworms or cut bait because of the mud, slime and foam). Fly fishermen sometimes catch and release more than 100 stripers a day! What an amazing success story!

CONTENTS

WILDLIFE IN NORTH CAROLINA

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

August 1999 *Volume 63, Number 8*

FEATURES

4 **A Golden Age for Wildlife?** *written by Carl Betsill*
photographed by William S. Lea ©1999
Rising deer, turkey and bear populations in North Carolina are making wildlife managers justifiably proud. Ironically, they're also threatening a backlash from a growing urban populace.

8 **Red Drum, Then and Now** *written by Joel Arrington* ©1999
Once the vaunted king of Outer Banks fisheries, the red drum—our state fish—is in trouble today. This veteran saltwater angler and observer compares the situation now to the way it used to be.

12 **Ecosystem of Castaways** *written by David S. Lee* ©1999
illustrated by Anne Runyon ©1999
Moving 100 miles each day on the open seas is a vast circle of seaweed that anglers call "The Yellow Brick Road." This community of sargassum seaweed hosts an incredible diversity of creatures.

18 **Our Mountain Medicine Chest** *written by Charles Dickson* ©1999
photographed by Hal Horwitz ©1999
Botanical ingredients are still the stalwarts in many modern medicines, and the Southern Appalachians boast the greatest number of plants used for medicinal purposes.

24 **Nature's Little Undertakers**
written and photographed by Harry Ellis ©1999
Without our notice, these diminutive beetles bury the carcasses of small dead animals, helping to recycle their raw materials.

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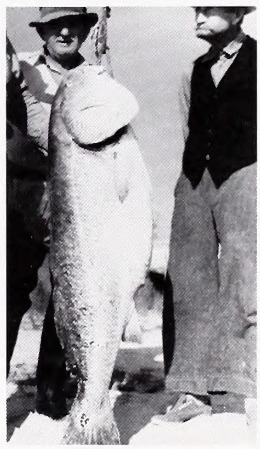

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Cover *As the rays of the setting sun fade, this fisherman gets set to land a nice red drum. Photograph by Melissa McGaw.*

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Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 919-733-4376. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Taming of the Shrew

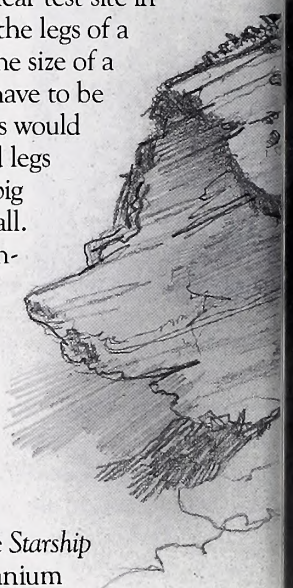
written by Roger Powell ©1999
illustrated by David Williams ©1999

In an old sci-fi movie, a mad scientist living on an isolated island developed shrews as big as German shepherds. These giant shrews had to eat their own weight in food each day and the mad scientist had a hard time finding enough food for them. The shipwrecked protagonists in the film were a welcome, though temporary, solution to the problem.

The film was preposterous because a shrew the size of a German shepherd would be unable to support itself on its skinny, shrew legs. A German shepherd weighs about 5,000 times more than a shrew, but shrew's legs on a German shepherd would only be 300 times thicker in cross section. The giant shrews would have crushed their own legs and collapsed.

For the same reason, the mastodons that once walked over North America had legs the size of elephants and not the size of white-tailed deer. No deer has ever evolved to be as big as an elephant, but if one did it would need elephant-sized legs. Animals' leg bones are sized to support not just the animal's weight but also the normal forces that the animal puts on legs by running, jumping and bounding. An elephant with legs proportional to a deer would at best be able to stand, but would break its legs with each step it took.

Another old sci-fi film dramatized what happened when ants at a nuclear test site in Nevada grew larger than horses. That couldn't have happened either—the legs of a giant ant would have crumpled under its weight. That's because an ant the size of a horse needs muscles the size of a horse's to move. Those muscles would have to be inside its legs because that's where ants have their muscles. But giant ants would not have enough space inside their legs for such muscles, unless they had legs bigger than stovepipes. Such legs would weigh more than the bone of a big mammal. Consequently, all animals with exoskeletons—like ants—are small.



The ants that terrorized Los Angeles also would have had trouble breathing. Insects have no lungs or gills. They obtain oxygen from tiny tubes that extend into their bodies from the surface to reach the cells. Oxygen diffuses down these dead-end tubes, but diffusion is a slow process. Thus, tubes much longer than half a centimeter would not renew their oxygen as fast as the nearby cells require. An ant 10 times longer than a modestly sized ant would weigh 1,000 times more, but it would have only 100 times more surface area in which to collect the necessary oxygen, not enough to keep it going.

Filmmakers continually make these kinds of errors. In the recent movie *Starship Troopers*, for example, the giant insects must have had legs made of titanium and some non-existent method of delivering oxygen to blood and to cells. In *Alien 3*, the terrifying mother of all aliens did not crumple her spindly, exoskeleton legs presumably because of weightlessness, but how she obtained oxygen or another source of energy while in a vacuum is hard to understand.

Although small animals have many advantages, big animals have other advantages. For one thing, big animals don't have to eat as much, proportionately speaking, as small ones. The mad scientist who developed the giant shrews did not understand this, for a shrew the size of a German shepherd would need no more food than a German shepherd. Large size brings economy of scale. A deer needs less food than 10,000 shrews whose total weight is the same. The heat that warms a shrew is generated by its internal organs. The internal organs of 10,000 shrews may weigh as much as a single deer's internal organs, but the shrews have 450 times more surface area than a deer, and that means a lot of their heat is lost. More heat loss means shrews have to generate more heat to keep their body temperature constant, and that means they have to eat more total food.

A shrew will forage for 30 to 45 minutes, rest for 10 or 15 minutes, then get back to work hunting for food, day and night, rain or shine, all year long. A mouse, which is a little bigger, eats and rests, then perhaps pauses for an extra scratch and stretch before getting back on the job. A deer, on the other hand, can fill its rumen and rest for hours while digesting its meal.

Thus, real people shipwrecked on a secluded island need not fear becoming food for giant shrews. Large size tames the shrew.

Other Reading

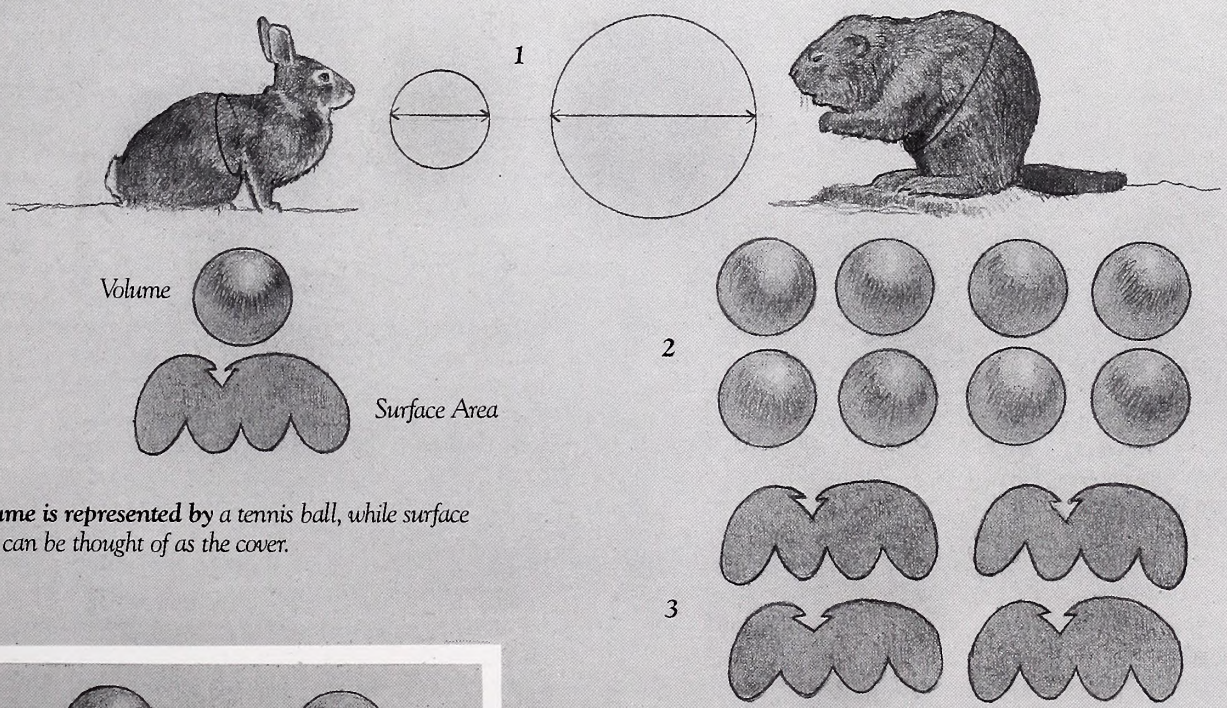
- Whitaker, John O. *National Audubon Society Field Guide to North American Mammals* (Knopf, 1996).

Surfing the Web

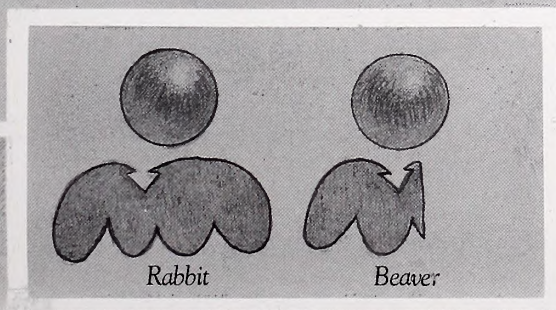
- For a web site devoted to mammals, see The University of Michigan Museum of Zoology's Animal Diversity Web page. Follow the prompts to "mammals" *Address:* http://www.oit.itd.umich.edu/projects/adw2k/index.html

In general, small animals, *like this shrew, must eat more often than large animals. The reason has to do with the amount of surface area an animal has in relation to its volume.*

The illustration below shows that *though a small beaver has a body only twice as thick as a rabbit (1), it has eight times the rabbit's volume and weight (2) and four times its surface area (3).*



Volume is represented by *a tennis ball, while surface area can be thought of as the cover.*



As a result, with half *as much surface area per each unit of volume as the rabbit, the beaver experiences less heat loss and eats less frequently. With twice the proportional surface area as the beaver, the rabbit loses more body heat and must eat more often.*

A Golden Age for Wildlife?

Rising deer, turkey and bear populations in North Carolina are making wildlife managers justifiably proud. Ironically, they're also threatening a backlash from a growing urban populace.

written by Carl Betsill / photographed by William S. Lea ©1999

What if you heard someone make this statement: "For many wildlife species, this may well be the golden age"? How you would you react? Would you be skeptical? With all the gloom and doom we hear about plummeting wildlife populations, how could anyone make such a statement?

Of course there's no doubt that many wildlife species in North Carolina have shown alarming declines over recent years. They include native freshwater fish and mussels, as well as songbird species associated with deep forest interiors. Species like the red-cockaded woodpecker that flourished with stable old growth longleaf pine forests are also in trouble.

But the fact is, many wildlife populations are doing better now at the end of the 20th century than when it started. The last native beaver was killed in North Carolina before World War I. Now many people consider beavers to be pests. Deer and turkey, the staples in the diet of early settlers and Native Americans, were virtually eliminated by the beginning of this century. The wild turkey is now found in 99 out of 100 counties, and deer are turning rural roads into obstacle courses. Many of the last remnants of the virgin forest were cleared in the 1910s, and along with them went drastic declines in bird species associated with these forests. But many of the forests that grew in their place are now reaching middle age and providing improving habitat for many species. High fur prices decimated populations of otters, raccoons and foxes by the 1940s. These species are now fully recovered.

Forest clearing and commercial harvests during the first half of the century didn't hurt all wildlife. Though species associated with older forests probably reached an all-time low, the populations of rabbits and quail, which prefer younger forests, were at an all-time high. When you consider the variety and abundance of at least the larger species of wildlife, however, wildlife is much better off today than it was when the century began.

This is certainly not what seems to be the common perception. Many people these days assume that all wildlife populations are declining. On a recent morning talk show, TV personality Jim Fowler showed a barred owl. The host casually commented: "Owls are endangered, right, Jim?" Disappointingly, Mr. Fowler made no comment and let the statement stand. The fact is, on an early spring evening in any hardwood bottom in the Southeast, you can be serenaded by dozens of barred owls courting and proclaiming their territories.

A couple of times a month, I get a call from someone proudly reporting that they saw a redheaded woodpecker in their yard! "Woodpeckers are endangered, aren't they?" they ask. I patiently explain that only one woodpecker is endangered in North Carolina, and it does not have a red head. The "rare and elusive" woodpecker usually turns out to be a mature red-bellied rather than the less common red-headed, and not even close to the endangered red-cockaded. I almost hate to tell them that red-bellied woodpeckers are as common as hush puppies at a pig pickin'.

People are amazed when I tell them there are river otters near Raleigh, black bears near Wilmington and bobcats near Charlotte. All three of these species have actually expanded their range within the past 10 years!

The recoveries are not limited to popular game species, either. As I watched two bald eagles feed on the Roanoke River near Williamston this spring, I remembered that when I moved to North Carolina just two decades ago, this sight would have been rare indeed. Many species of hawks and owls are making dramatic comebacks. Even the bluebird, thought to be on the way out a couple of decades ago, is actually fairly common these days.

Other animals seem to be expanding their range into areas of the state where they have never been seen before. The groundhog is a good example. Until recently, the groundhog was considered a mountain critter. Who would have imagined that they can now be found all the way to the coast? Common calls to our office these days come from eastern North Carolina residents wanting to know what are these strange, rodentlike animals with bottlebrush tails that are taking up residence under old tobacco barns.

Of course, wildlife is not the only thing expanding its range and populations. North Carolina is experiencing unprecedented human population growth. It really makes one wonder whether we may be experiencing a temporary bump upward in the steady trend toward declining wildlife diversity. Can we really maintain this rich wildlife heritage?

Several factors will determine this. These factors can be illustrated with what is happening to our deer populations. In a report prepared for the N.C. General Assembly, Scott Osborne, our state Big Game Program coordinator, noted that in 1978 an estimated 573 deer-vehicle accidents occurred per year on our state highways. By 1994, the number of deer-related accidents had risen to 8,000.

Far from declining, *many wildlife populations are flourishing in North Carolina as we enter the next century. Bald eagles have rebounded in recent years, expanding their range, and white-tailed deer are doing so well that some homeowners now consider them pests.*

Last year, more than 12,000 deer-vehicle accidents occurred in the state. Osborne found that, although deer populations had increased, the number of deer-vehicle accidents was more closely related to the increase in miles driven than to deer numbers.

As urban sprawl continues, it has a three-pronged impact on animals, including deer. First, more deer are killed on highways. Surprisingly, for deer populations as a whole, this is not the major problem. Deer reproduction can easily keep up with the mortality suffered on highways.

The second impact is the loss of habitat, when roads, shopping centers and residential areas displace deer. This has a cumulative and lasting impact. Once an area is paved over, it will most likely never be deer habitat again. Eventually, as growth and development continue, deer and other wildlife populations will have to decline.

The third impact to deer and other wildlife is people's lack of tolerance for moderate-to-high wildlife populations. This may be the most significant of all. As deer-vehicle accidents increase, there is but one solution in most people's minds: reduce the deer populations. Reducing speed limits after dark would dramatically reduce accidents involving deer, but this issue is not even given consideration. No one wants to be inconvenienced by wildlife. Pressure to reduce the deer herd is also coming from insurance companies that see deer-vehicle accidents affecting their bottom line. The best solution for them would be no deer, period.

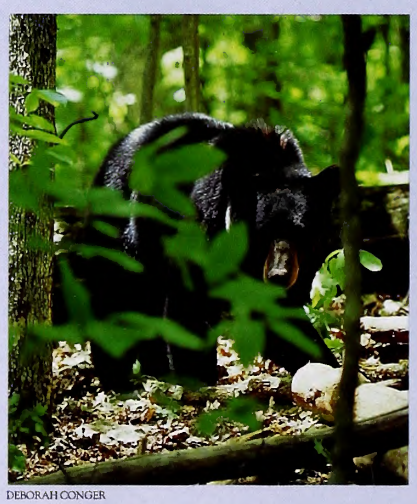
More and more, it seems people are developing the NIMBY attitude toward wildlife. The acronym originally applied to development projects. Everyone sees the need for a sanitary landfill, as long as it's Not In My Backyard. Everyone loves to see white-tailed deer, until they see them frozen in their headlights or munching on their lovely azaleas. "I don't want them hurt; just get them out of my backyard" is getting to be the common theme.

Some of this growing intolerance for wildlife has resulted from the recent increase in rabies. Many people who see a raccoon, fox or opossum in an urban area immediately call a government agency to come get the animal. One lady recently told me that she moved to the city to get away from wild animals, that she was afraid of them and wanted them gone. Though we currently do not allow the removal of wild animals unless they cause property damage or are obviously sick or injured, pressure on government agencies to change their policies will increase as more people develop attitudes like this lady who moved to the city. Any risk from a wild animal—no matter how small—is considered by many to be too much.

Increasing numbers of people would like to see wildlife on wildlife preserves or on television, but "not in my backyard." A recently retired wildlife employee got rather frustrated with such a caller during his last few days of employment. Having a "short-timer's" attitude probably made him a little blunter than usual. The conversation went something like this:

Caller: There is this bird outside my window singing all night long and keeping me awake. Birds are not supposed to sing at night are they?

"THE ATTITUDE OF THE PUBLIC HAS AS MUCH TO DO WITH HEALTHY AND DIVERSE WILDLIFE POPULATIONS AS ANYTHING ELSE."



DEBORAH CONGER

Short-timer: Some do. It is probably a whippoorwill or a chuck-will's-widow. They are quite common this time of year and have a more or less continuous song.

Caller: What are you going to do about it? I can't sleep!

Short-timer: Where do you live?

Caller: In north Raleigh, in that new development on Falls Lake.

Short-timer: Why did you move to that area?

Caller: We...well, we always wanted a place in the country. What has that got to do with anything?

Short-timer: Well, now that you have that place in the country, you need to know that wildlife is a part of it. I hope you eventually learn to enjoy the call of the whippoorwill. Have a nice day. Click.

Wildlife has always been important to Americans in one way or another, but for an increasing number of North Carolinians, expanding native wildlife populations are proving nearly as popular as an invasion of killer bees. Ironically, after a century in which society has struggled to protect and manage wildlife populations, we may have grown so distant from the land that we don't know how to handle our own management successes!

The next century will be interesting, indeed. We enter the 21st century with plenty of deer, turkeys, bears, otters, bobcats, foxes, geese, squirrels, hawks and owls. All are big, visible critters with plenty of potential interaction with humans. We have a human population that loves what wildlife represents, loves the thought of wildlife "out there," as long as "there" is on TV or in some national park somewhere else. People draw the line with geese pooping on their sidewalk, however. This nature stuff is all right until it gets down and dirty.

The concern up until now has been protecting habitat from development, but the additional threat of intolerance toward wildlife may be as real as habitat destruction. In a recent trip to Russia (see January 1998 *Wildlife in North Carolina*), I saw just how severely attitudes toward wildlife can impact wild animal populations.

In the rural area of eastern Russia that I visited, wildlife habitat existed in abundance. There were no shopping centers or urban sprawl. Unpaved roads, abandoned farms and old-growth forests were plentiful. Nowhere in the United States have I seen such abundance and diversity of wildlife habitat. Yet when I walked the fields, ditches and creek banks looking for tracks, I saw nothing. In North Carolina—with poorer and more fragmented habitat—I can find a raccoon, opossum or fox track almost anywhere I look. What is the difference? The answer is public attitude.

Because of the economy in this area of Russia, any animal big enough to eat or use is taken. Fortunately, our situation here is not the same, and as long as our economy remains healthy, we won't be faced with the problems Russia has. The point is that habitat is not everything. The attitude of the public has as much to do with healthy and diverse wildlife populations as anything else. If the NIMBY attitude toward wildlife continues and becomes the predominant mindset, we can look for significant declines in our rich wildlife heritage.

KEN TAYLOR

The sight of a fine *white-tailed buck can uplift the hearts of hunters and naturalists alike. But in the path of an oncoming car or munching on your prized azaleas, the same animal can be viewed as a nuisance. As suburban populations continue to expand into the country, encounters between humans and wildlife will become even more common.*

In most countries and even many parts of the United States, human populations are concentrated around large urban centers. In North Carolina, everyone seems to want that "home in the country." As a result, we probably have more human-wildlife interactions than most places in the world. Isn't this a good thing? Isn't this what everyone wants? Yeah, but get that bear out of my backyard!

As we enter the 21st century, those of us who want to protect and conserve wildlife will have a new challenge. Not only will we face human growth and development encroaching on continually shrinking wildlife habitat; we will also face growing numbers of people who have little understanding of wild animals. They will have little tolerance for wild creatures and will refuse to be inconvenienced by them. This may be the greatest challenge of all for the future of our wildlife resources. ⊠

Carl Betsill is a wildlife biologist with the N.C. Wildlife Resources Commission.

RED DRUM
THEN & NOW

Once the vaunted king of Outer Banks fisheries, the red drum—our state fish—is in trouble today. This veteran saltwater angler and observer compares the situation now to the way it used to be.

written by Joel Arrington ©1999

Nags Head, 1939

N.C. ARCHIVES AND HISTORY

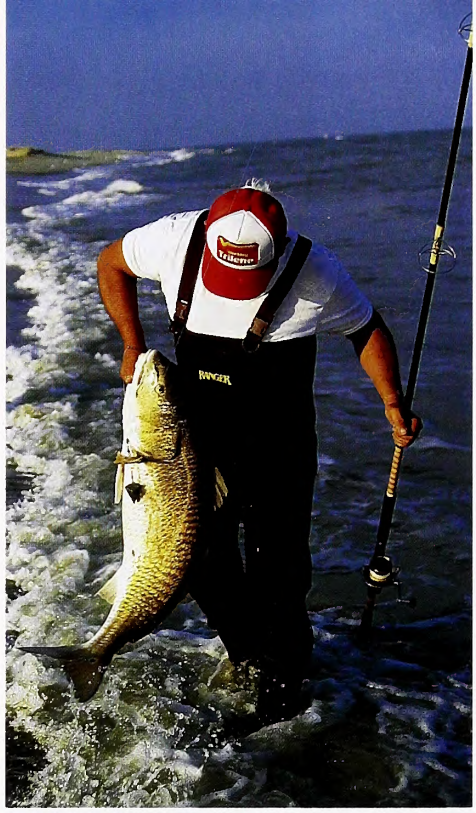
In North Carolina? Impossible, many saltwater anglers must have thought. Faced with evidence that an insufficient number of red drum were reaching spawning age, the N.C. Marine Fisheries Commission recently reduced the number of red drum that fishermen can keep from five to one fish a day.

The action was a rude awakening for surf-casters along the coast. For at least 70 years, red drum had been the crown jewel of Outer Banks fisheries. The size of red drum here was unrivaled throughout the species' range, which, at the beginning of the 20th century, had stretched from New York to Texas. Now, however, the continental range has shrunk, and the Pamlico Sound stock is being characterized as much diminished and severely overfished. How could we have come to this?

In 1889, North Carolina led the South Atlantic states in seafood production, including more than 270,000 pounds of fresh and salted red drum sold at market that year. In the early 1900s, recreational saltwater fishing gained popularity, and fishermen encountered vast schools of red drum. In two of the earliest magazine articles ever published about North Carolina fishing, Don Carpenter, a writer for *American Motorist*, described trolling from a chartered boat outside the breakers of Oregon Inlet in the fall of 1929 and seeing thousands of fish. Reportedly, he and his crew boated a healthy share that weighed 25 to 56 pounds.

Carpenter, who I interviewed when he visited Nags Head in the 1970s, noted how birds wheeled and fed over the schools. The lures used were highly polished No. 7 Pflueger Record spoons. The rods had split bamboo tips and hickory butts fitted with locking reel seats and sets of double German silver guides with agate liners.

Phillip Mayer, a much-traveled angler at the turn of the century, was quoted in a 1937 issue of *Salt Water Fishing* as saying,



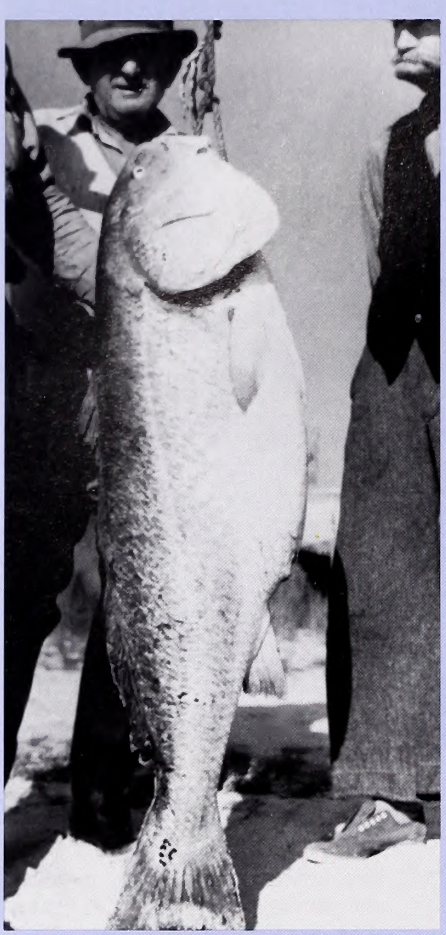
JOEL ARRINGTON

***Red drum have been** a hallmark of North Carolina Outer Banks fishing since the turn of the century. But with their numbers now threatened by pollution and over-fishing, the N.C. Division of Marine Fisheries has set strict new regulations to boost their population.*

"In my boyhood days, channel bass were being caught regularly off the Long Island coast. When I started to fish the New Jersey coast, in 1893, at such places as Corson's Inlet and Barnegat Inlet, channel bass were more than plentiful. Fishermen often regarded them as a pest."

Mayer spent 1932 at Ocracoke. He reported that fishing between June and September was poor that year, but that during October and the first 20 days of November he landed 377 red drum in the surf—"all large fish." Mayer credited a mild November and noted "the water was clear and the fish were large and plentiful." At that time, great care was necessary to avoid over-casting. "For the first time in my life," Mayer wrote, "I had had my fill of fishing. Fully 80 percent of all fish caught were returned to sea."

Outer Banks natives grow up where fishing remains an integral part of life. In the 1940s, a U.S. Coast Guard lookout, commanding a view of the surf at the village of Kinnakeet (now called Avon), would blow a whistle when he saw a school of red drum in the surf, according to Cyril Gray, a lifelong resident of Hatteras Island. The teacher would dismiss school, and the children would run down to the beach and cast bait on



N.C. ARCHIVES AND HISTORY

RED DRUM FACTS

The red drum, North Carolina's state fish, lives in coastal and estuarine waters from Massachusetts to Mexico, feeding on crabs, shrimp, menhaden, mullet and spot. Most North Carolina red drum reach sexual maturity by age four, when they are 30 to 37 inches long. They spawn in near-shore waters around inlets from early fall to late winter. Their eggs hatch within 24 hours and are carried into the estuaries by tides and wind.

Like 90 percent of North Carolina's economically important species, red drum are estuarine-dependent during the early stages of their life cycle. As they mature, they are found more frequently in the ocean, but continue to use the estuaries and inlets to feed and spawn. Though the numbers of larger and older fish have declined, some fish still may survive at least 60 years. This year, the International Game Fish Association lists 16 out of 20 red drum line-class records from North Carolina's Pamlico Sound or nearby waters.

handlines. The braided line was less than 1/8-inch thick and held a weight of as much as a pound. The angler looped a section of line around a short piece of willow stick, whirled the weight around his head and cast up to 50 yards. Gray said that such drum appearances in the surf were not uncommon when he was a boy.

By the 1960s, however, commercial and recreational landings of red drum had expanded, and signs of unsustainable harvest had become widespread. Bernard Yokel, an early marine scientist at the University of Miami, warned that the red drum range had receded south, and populations had diminished. According to his research, commercial landings in New Jersey totaled 256,000 pounds between 1926 and 1961, but since 1950 no significant commercial red drum catches had been tallied north of Chesapeake Bay. By mid-century, he believed, the northern edge of the species' range had eroded from New York to Virginia.

A half century later, there are now signs the range of the red drum could be threatened in North Carolina's Pamlico Sound. The N.C. Division of Marine Fisheries (DMF) has tagged red drum since 1983 to determine seasonal occurrence, migration and growth. Of some 9,000 juvenile red drum tagged between 1991 and 1993, only 1 percent was recaptured as spawning-sized adults.

The DMF also determines stock health by monitoring the spawning potential ratio. The ratio is 100 percent if no fishing occurs and fish die only from natural causes. A typical ratio for a healthy population is 40 percent. For North Carolina red drum last year, the ratio was calculated at less than 10 percent. A DMF staff report in 1990 concluded that the abundance of drum 20 to 55 years old had declined 90 percent since the period 1968 to 1972.

Increasingly tighter harvest restrictions have been imposed since 1976, but with little success. The combined recreational and commercial catch fell from an annual average of 400,000 pounds in the early 1990s to 110,000 pounds by 1997.

NORTH CAROLINA RED DRUM

1976

Minimum size is set at 14 inches, with no more than two fish per day exceeding 32 inches in total length permitted. The state bans gaffs for removing fish from nets.

1990

South Atlantic Fishery Management Council prohibits possession of red drum in federal waters offshore. The N.C. Marine Fisheries Commission limits the annual commercial catch, first to 300,000 pounds, then a year later to 250,000 pounds. Anglers are limited to five fish a day between 14 and 32 inches in length, with no more than one greater than 32 inches.

1991

Minimum size is increased to 18 inches.

1992

Creel limit is set at five fish between 18 and 27 inches in length with no more than one greater than 27 inches.

Even so, the news isn't all dire. Red drum spawn with widely varying success. Biologists believe conditions in 1996 were so good, a bumper crop of puppy drum (immature red drum) resulted in an abundance of two-year-old fish last year. Some netters reported landing several hundred pounds daily. By October the commercial quota had been reached and, for the first time since an annual quota was first established in 1990, the season was closed for the remainder of the year.

As an interim measure last year, the Marine Fisheries Commission cut anglers' daily red drum limit from five fish to one. The keeper must fall between 18 and 27 inches in total length. The agency also further restricted net fishing. Licensed professional fishermen were limited to 100 pounds daily year-round and were required to attend small-mesh gillnets at all times during the warm months. The attendance requirement ensures watermen will check nets in a timely fashion, because non-targeted fish become stressed faster in warm water. However, responding to requests of commercial fishermen, some attendance requirements were relaxed to allow directed fisheries for spot, mullet, bluefish and Spanish mackerel. The agency held steady the annual commercial limit first set in 1991 at 250,000 pounds, a level not much less than total landings in 1889.

The new state regulations are temporary, until a management plan can be implemented possibly by the end of next year. We can only speculate about future harvest restrictions, but veteran observers do not anticipate more liberal catch limits for some years to come.

The "Point" at Cape Hatteras remains one of the few places where schools of red drum may approach the beach in anything like the numbers Mayer reported at Ocracoke in 1932. But even at Hatteras, the occurrence is unusual. Most surf fishing requires patience and determination to soak bait all night and for days, usually in rough spring and fall weather.

Few anglers troll for red drum any longer, but some fish can still be caught that way. Anglers fish from boats today either with bait on the bottom or by casting lures to visible schools or into areas judged likely to hold fish. Occasionally, Cape Hatteras and Ocracoke Inlet, more than any other locations in the state, produce fishing reminiscent of the old days. In 1997, anglers released so many fish at Hatteras (and at a few other locations) that citations in the North Carolina Saltwater Fishing Tournament ran 42 percent over the long-term average. And that was in a year when commercial and recreational red drum landings fell to an all-time low.

Fisheries managers, commercial fishermen, conservationists and anglers will, as required by the state's 1997 Fisheries Reform Act, decide the fate of North Carolina red drum into the next millennium. Whether we will achieve a sustainable level of harvest, we will not know until some years after a management plan goes into effect. But with patience and cooperation, the red drum can return as the crown jewel of Outer Banks fishing. ⊠

REGULATION CHRONOLOGY

—Courtesy of the N.C. Division of Marine Fisheries

JOEL ARRINGTON

1994

Sale of fish over 27 inches total length is prohibited.

MELISSA McGAW

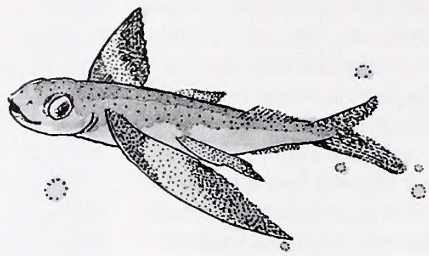
1998

Marine Fisheries Commission cuts anglers' daily limit from five fish to one. The keeper must fall between 18 and 27 inches long. Licensed professional fishermen are restricted to 100 pounds daily year-round, with attendance of small-mesh gillnets required during the warm months.

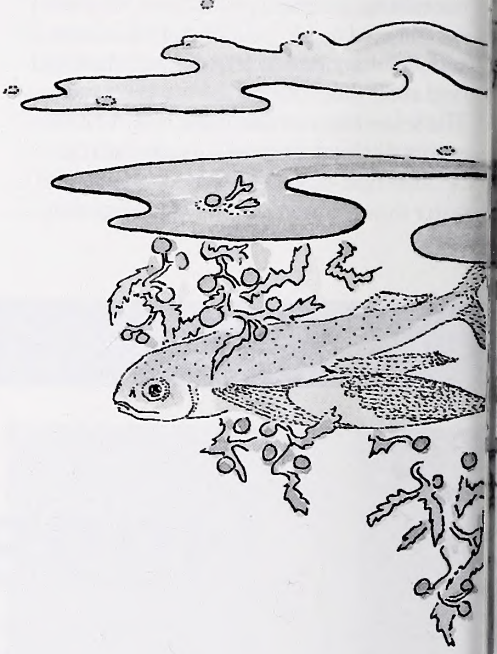
MELISSA McGAW

1999

Marine Fisheries director amends the small-mesh gillnet attendance requirement to allow directed fisheries for spot, mullet, bluefish and Spanish mackerel. The nets still must be attended in the warm months when they are set within 200 yards of a shoreline, in all designated primary and secondary nursery areas and in all "no-trawling areas." Attendance is also required in portions of rivers connected to Pamlico Sound. The annual commercial quota remains approximately equivalent to landings 100 years ago—250,000 pounds.



ECOSYSTEM of *Castaways*



Moving 100 miles each day on the open seas is a vast circle of seaweed that anglers call "The Yellow Brick Road." This community of sargassum seaweed hosts an incredible diversity of creatures.

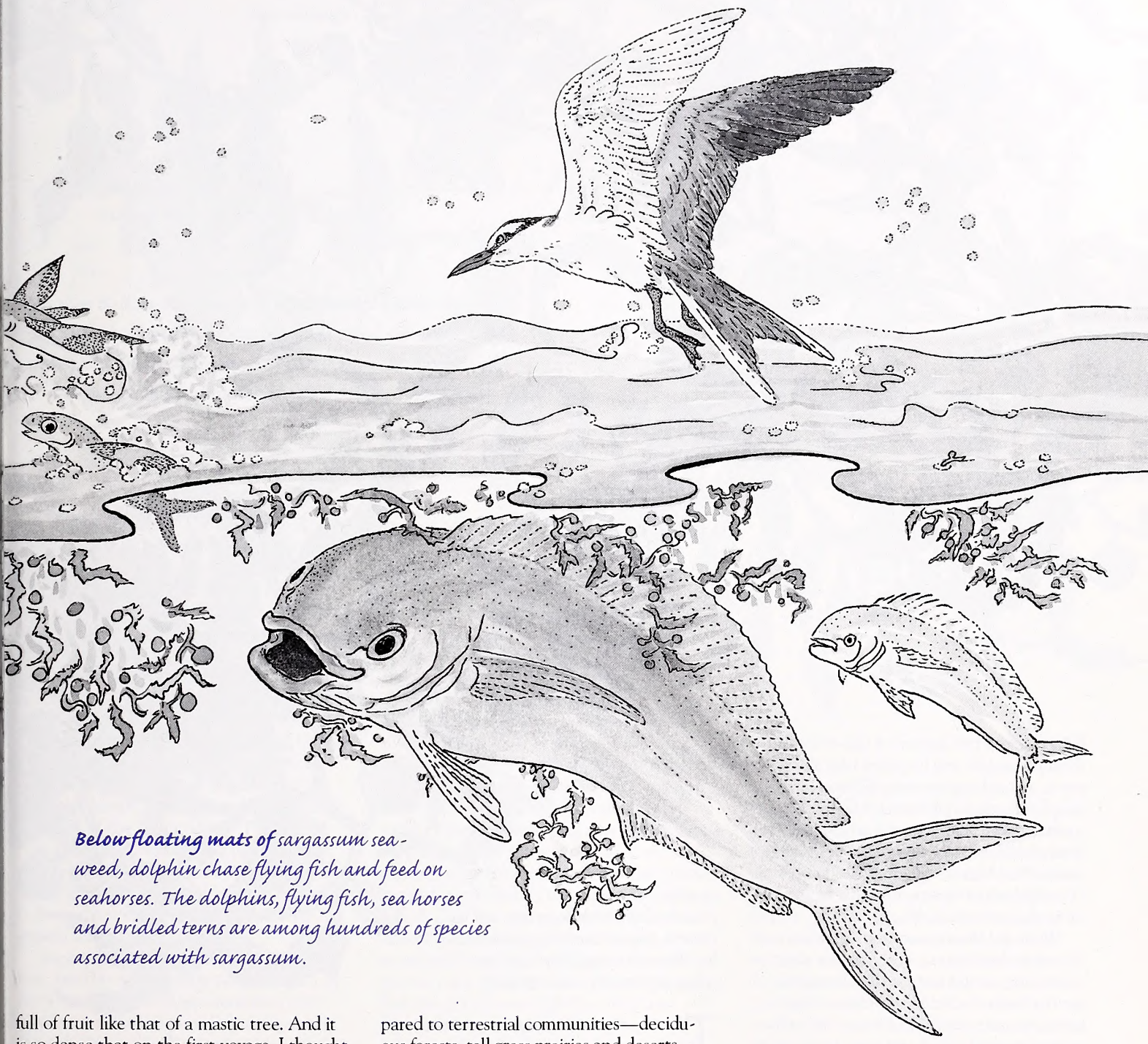
written by David S. Lee ©1999
illustrated by Anne Runyon ©1999

sargassum weeds

There is nothing particularly impressive about sargassum. Also called gulfweed, it's a blotchy brown seaweed that develops air bladders that keep its flexible branches afloat and near the surface, assuring a good distribution of light to the plant's surface. About eight species comprise the genus, although biologists have found that two of them make up more than 90 percent of the plant community. For the longest time, it was assumed that the gulfweed seen drifting at sea was simply an accumulation of sargassum that had broken free from inshore algae beds. However, these are not inshore species; they lack the "holdfast" their coastal relatives use to grasp the bottom. Rigid supportive structures do not work in a world of pounding waves and rushing tides.

Were it not for the circular currents of the North Atlantic, the algae would be caught up in ocean currents that would transport them into areas too cold and with too few hours of daylight to support growth. Instead, sargassum moves in a clockwise gyre, the center of which is the Sargasso Sea. In this area which is roughly the size of the United States, where the water is comparatively motionless, large concentrations of these plants grow and accumulate.

Large concentrations, I say, not infestations. The warm Sargasso Sea is not a solid tangle of algae. The plants live and grow only in a very thin layer near the surface. They drift in small patches; a patch an acre in size is unusual. Nonetheless, even now serious authors sometimes describe the Sargasso Sea as so thickly matted with seaweed that vessels have trouble passing through it. This idea probably originated from the journals of Columbus' third voyage. He writes: "And I also found all the sea full of vegetation of a kind which resembles pine branches and very



***Below floating mats of** sargassum seaweed, dolphin chase flying fish and feed on seahorses. The dolphins, flying fish, sea horses and bridled terns are among hundreds of species associated with sargassum.*

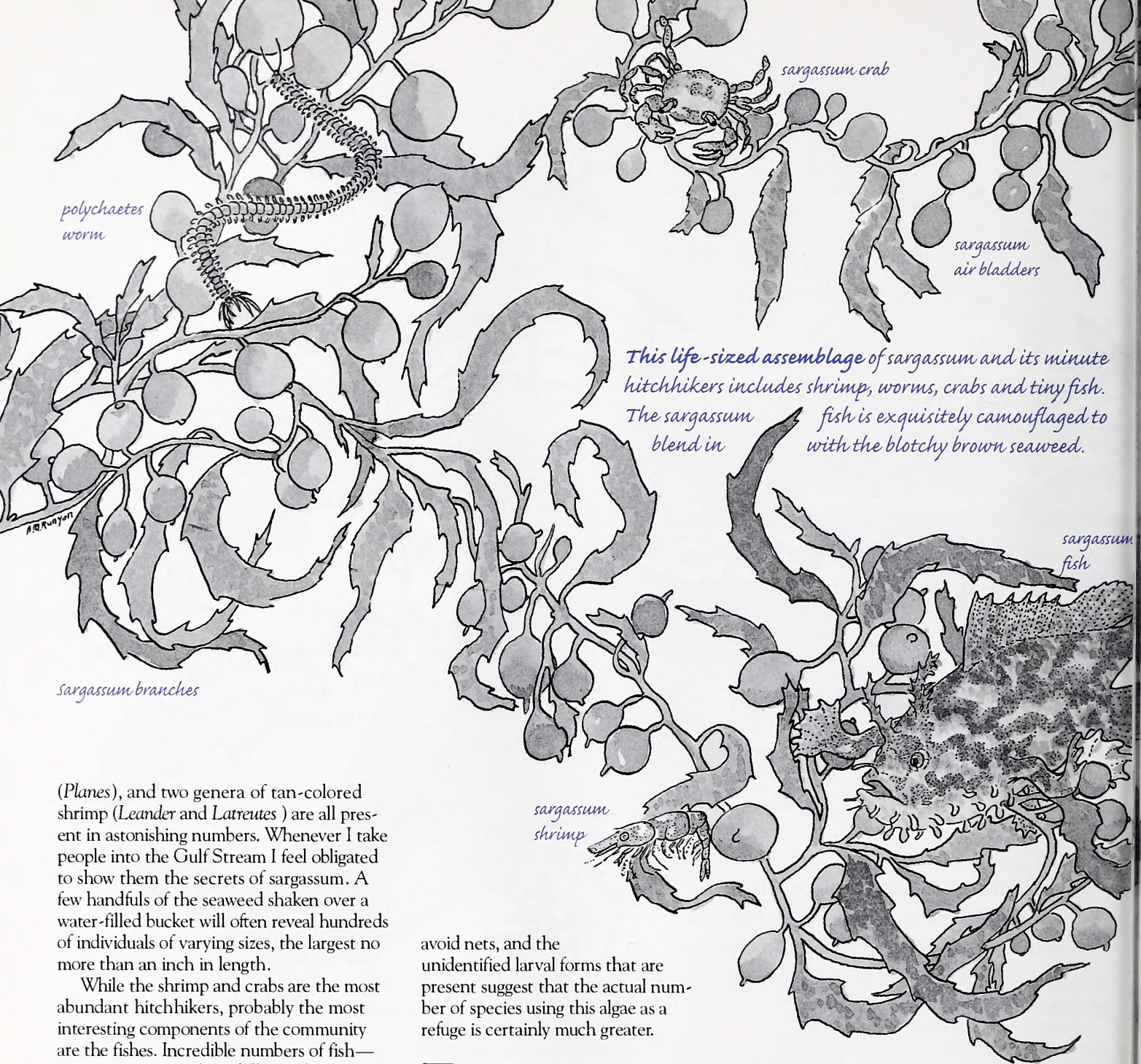
full of fruit like that of a mastic tree. And it is so dense that on the first voyage, I thought that it was a shallow and that the ships would run aground . . . ." That it thrives here at all is a biological curiosity. The Sargasso Sea has little plankton and the clear, nutrient-poor waters have often been referred to as a biological desert. At peak abundance this seaweed accumulates at densities of 2 to 5.5 tons per square mile, more than a thousand times less dense than crops of related algae growing along the rocky Maine coast.

Nevertheless, sargassum is a biological community. Hiding in the plants, clinging to them, crawling among them and swimming beneath them is a wonderful variety of marine animals that form an ecosystem of castaways. Compared to terrestrial communities—deciduous forests, tall grass prairies and deserts—sargassum is an ecosystem in motion.

The number of individual animals living in the sargassum is impressive. Biologists from the Virginia Institute of Marine Science collecting 34 dip net samples from off Cape Hatteras and the adjacent Sargasso Sea and found 11,234 free-living invertebrates and fishes, representing a total of 67 species. The colonists of this community come from all of the major evolutionary lines of the animal kingdom, and most have taken on the sober hues of the yellow and brown algae. Their splotchy molded patterns match the sargassum so well that casual observers miss the teeming life there.

The most common animals are the least obvious. They live in self-oozed limy houses that adhere profusely to the algae. Hydrozoans, bryozans, barnacles and polychaete worms are present in such numbers that the algae feels hard and rough to the touch. Most of these inhabitants are filter feeders, capturing minute prey in pulsing nets and tentacle-like arms. On the older plants, the growth often weighs down the plants, pulling them away from the surface. In the decreasing light they eventually die.

More conspicuous are the larger free-living invertebrates. Marine snails, several species of brown-blotched swimming crabs



This life-sized assemblage of sargassum and its minute hitchhikers includes shrimp, worms, crabs and tiny fish. The sargassum fish is exquisitely camouflaged to blend in with the blotchy brown seaweed.

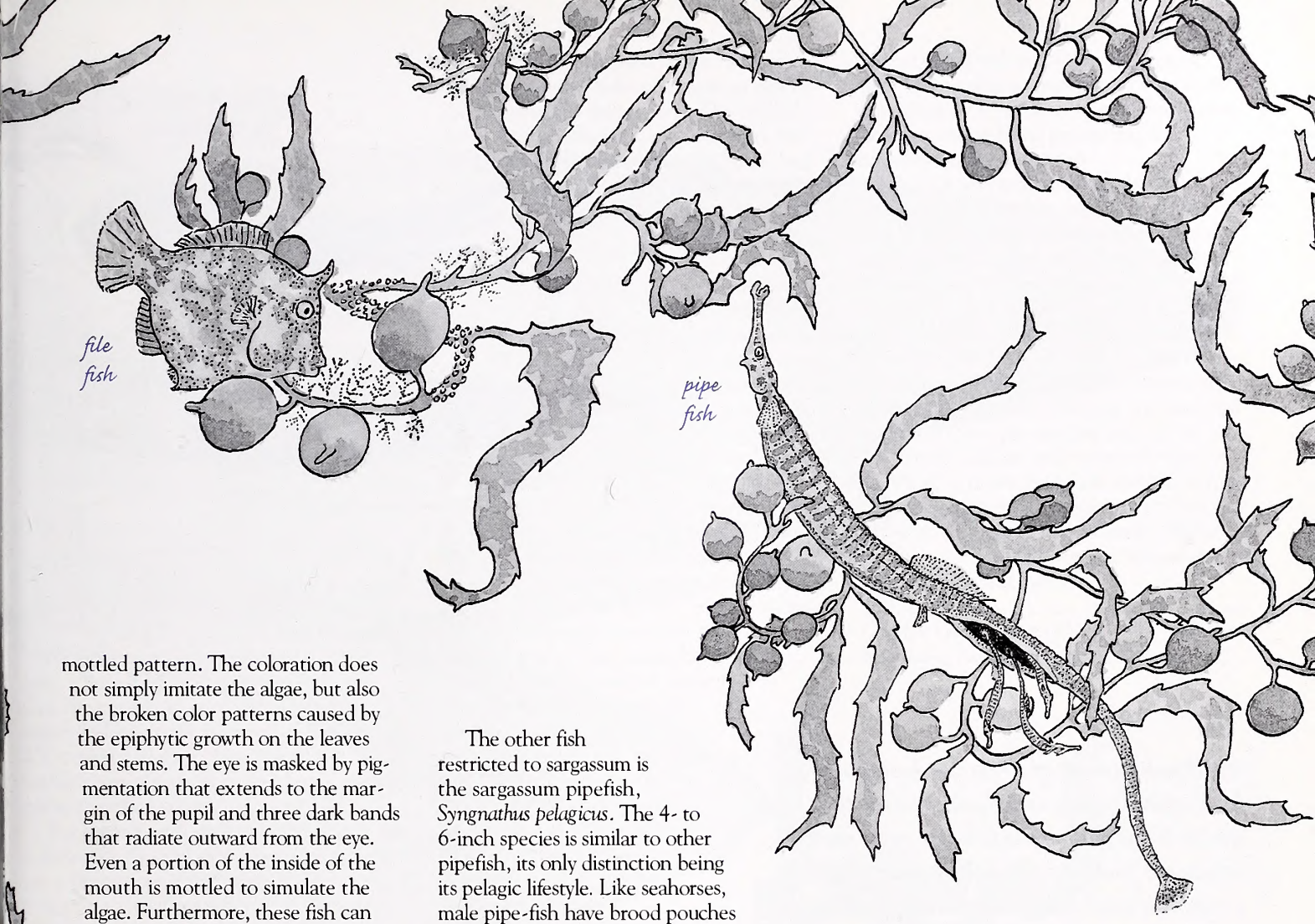
(*Planes*), and two genera of tan-colored shrimp (*Leander* and *Latreutes*) are all present in astonishing numbers. Whenever I take people into the Gulf Stream I feel obligated to show them the secrets of sargassum. A few handfuls of the seaweed shaken over a water-filled bucket will often reveal hundreds of individuals of varying sizes, the largest no more than an inch in length.

While the shrimp and crabs are the most abundant hitchhikers, probably the most interesting components of the community are the fishes. Incredible numbers of fish—some estimate nearly 17 billion—live in the sargassum of the North Atlantic. Many types spend their entire lives in sargassum; others find the algae a convenient shelter during the early parts of their lives; still others congregate here as adults to prey on the inhabitants. There are no fewer than 23 families and 54 species represented in the sargassum of the Gulf Stream off the southeastern coast. In 1966 and 1967, researchers collected and sorted through 3.5 tons of sargassum pulled from the sea off Florida. Their analysis yielded approximately 8,400 individual fish. Many species occur with regularity and in abundance, while others have been recorded on only a few occasions. The vastness of the Sargasso Sea, the ability of many fishes to avoid nets, and the unidentified larval forms that are present suggest that the actual number of species using this algae as a refuge is certainly much greater.

The most specialized member of the community is the appropriately named Sargassum fish, *Histrio histrio*. It is a member of the family of frogfishes—squatting, bottom-dwelling creatures that prey by deceit on other fishes. They can swallow fish up to their own size and even ones that are somewhat larger. Sargassum fish are pelagic frogfish counterparts that lurk among the sargassum stalks waiting to ambush whatever hapless fish come by, including other Sargassum fish. They also possess a modified first dorsal fin ray that is positioned far forward of the other fin rays. Wiggled as a lure it has a fleshy "bait" at the end that attracts other fish to within gulping range.

As a teenager I was fascinated by these odd little fish—a big specimen is no more than an inch and a half long. I would look for them by sorting through sargassum mats that had drifted close to the beach on lazy summer days. On rare occasions when I would find more than one of these fish, only one would be left by the time I got home. In aquariums, I discovered that sargassum fish had to be kept by themselves or within a week or two they would have eaten everything else in the tank.

To aid this fish in snatching prey, it has developed one of the best examples of camouflage to be found at sea. Small white spots and lines superimpose the yellow-and-brown



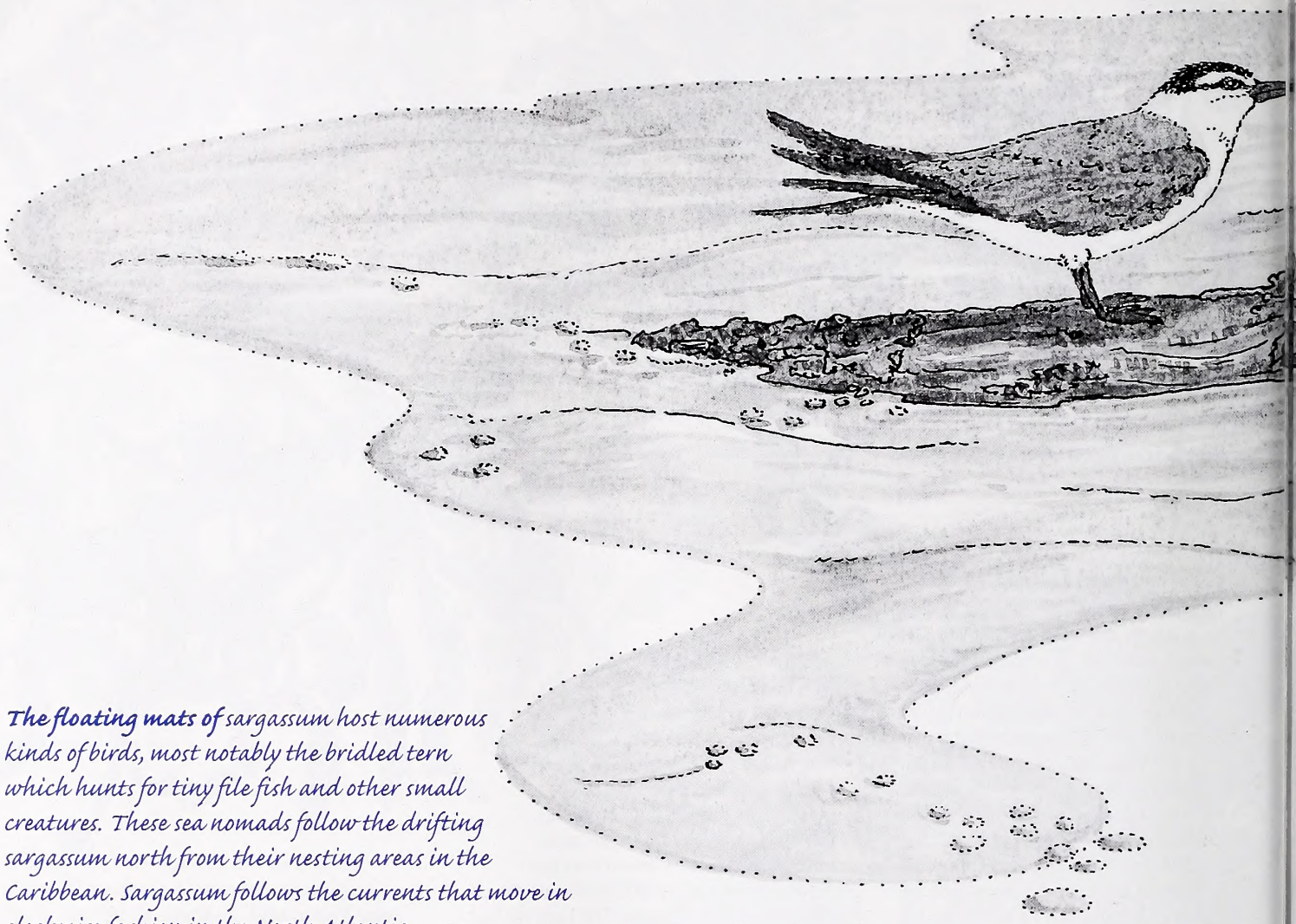
mottled pattern. The coloration does not simply imitate the algae, but also the broken color patterns caused by the epiphytic growth on the leaves and stems. The eye is masked by pigmentation that extends to the margin of the pupil and three dark bands that radiate outward from the eye. Even a portion of the inside of the mouth is mottled to simulate the algae. Furthermore, these fish can change color rapidly from light to dark. Changes can be produced by stimulation or by major changes in the color of the surroundings. The fins are modified into hand-like appendages and the pectoral fins have arms that allow the fish to grasp the algae and to crawl through it. Even the fin lobes match in shape the growth habits of the gulfweed.

Sargassum fish have a reduced gill structure, but this is apparently not a problem in the wave-washed, oxygen-saturated environment in which it lives. By forcing water through the small gill opening, these fish can even jet propel themselves for short distances to escape predators. They are weak swimmers, but males at least swim from one algae patch to another during the mating period. More often, however, even this is not necessary because patches of gulfweed are constantly breaking apart and reforming with adjacent ones. The fish are transported passively from clump to clump. At other times adult sargassum fish consider as prey any fish their size or smaller, so it is unusual to find more than one *Histrio* per clump of gulfweed. Courtship lasts for a few hours up to one day and fertilization occurs in a brief second encounter. The male moves on or is eaten.

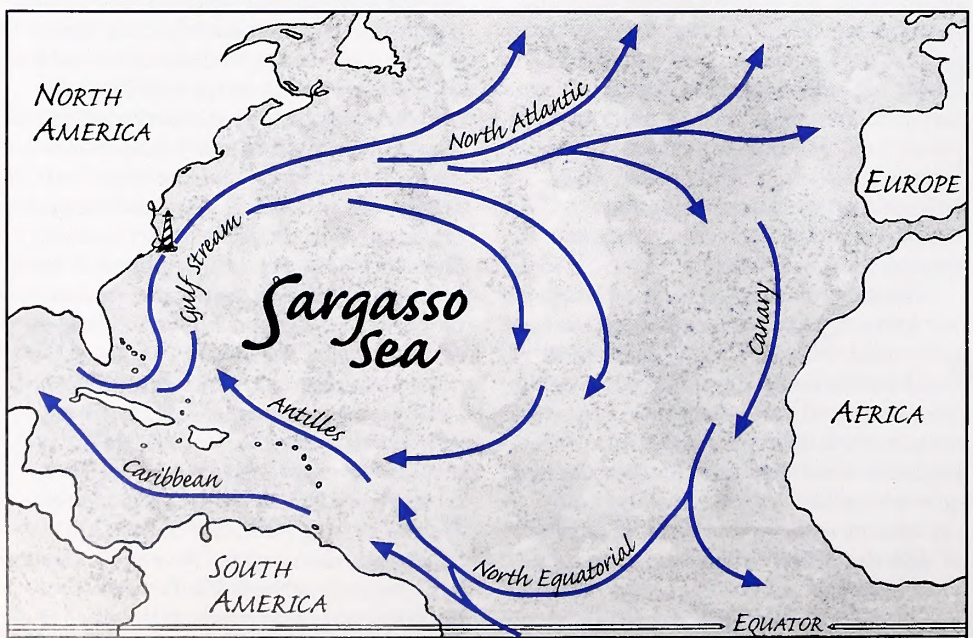
The other fish restricted to sargassum is the sargassum pipefish, *Syngnathus pelagicus*. The 4- to 6-inch species is similar to other pipefish, its only distinction being its pelagic lifestyle. Like seahorses, male pipe-fish have brood pouches on the undersurface of the tail into which the female deposits eggs. The eggs are laid in modest numbers and develop in the male's pouch. Researchers have shown that despite the large amount of yolk present in pipefish eggs, the embryos receive additional nourishment directly from the male. The pouch fluid is a source of calcium for the dozens of growing egg-bound young. It is extracted from the bony rings of the male parent's tail. Furthermore, on some pipefish the pouch is so tightly sealed that biologists suspect gases and nitrogenous waste products are conducted out through the pouch lining.

The larval stage is largely completed within the egg, causing a rather long incubation period. When the young finally hatch they look like miniature adults. While some are transported passively by currents, all start out their lives in the same sargassum patches in which they were hatched. As they grow into adults, however, they have the opportunity to disperse as different patches of algae drift together only later to be separated by storms and currents.

Off our coast, gulfweed is transported northward 100 miles or more a day by the Gulf Stream. It may be off the Carolinas for a few days in May, somewhere east of New Jersey in early June, and by July it's near the Azores. The stream takes a sharp turn at Cape Hatteras and heads out into the international waters of the Atlantic bearing the buoyant beds of marine algae and the community of animals that regard this patchy, current-swept world as their own. As sargassum moves northward in the stream, the number of fish associates decreases, and by the time the sargassum reaches the Azores only six species are present. In some cases this is clearly a result of different fishes completing segments of their life cycle and moving out of the community. In others it probably is an indication of the mortality of individual species transported into more northern latitudes. And based on my past attempts to keep Sargassum fish in aquariums, the reduced survival may also be explained by predation. Nonetheless, some Caribbean species complete the trip moving northwest in the Gulf Stream and then pass the Azores, Portugal, Madeira and northern West Africa. The northern and eastern part of the journey is completed on the north Atlantic drift and the Canary Current.



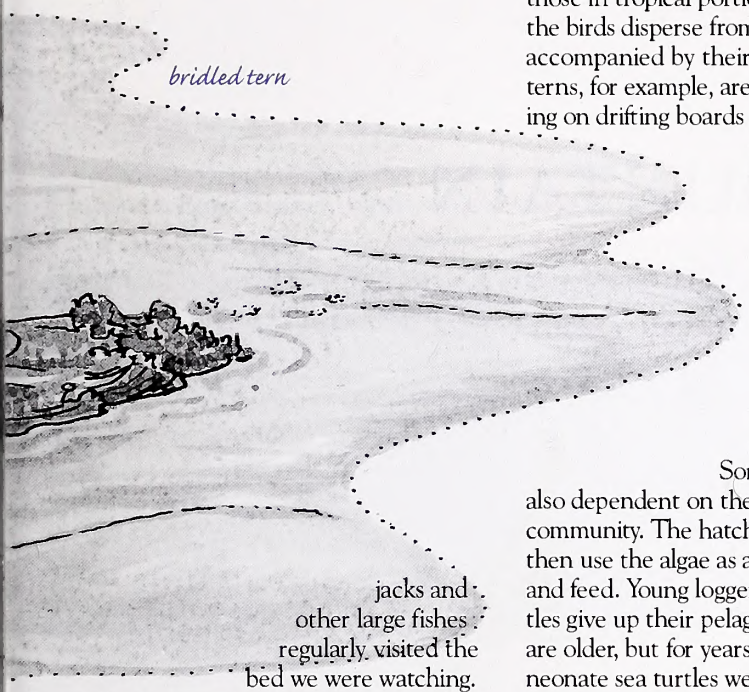
***The floating mats of** sargassum host numerous kinds of birds, most notably the bridled tern which hunts for tiny file fish and other small creatures. These sea nomads follow the drifting sargassum north from their nesting areas in the Caribbean. Sargassum follows the currents that move in clockwise fashion in the North Atlantic.*



Encircled by strong currents, the Sargasso Sea lies in the North Atlantic Ocean.

With such a dependable prey base, certain oceanic fishes find sargassum beds ideal foraging grounds. Peering down into the blue waters of the Gulf Stream one can make out the forms of larger fishes as they cruise beneath the drifting seaweed. Conventional surface sampling with various types of nets does not obtain the fast swimming predatory species. Nevertheless, the fish are there, often stacked in layers. Sport fishing off the Outer Banks of North Carolina shows that dolphin and wahoo are frequently associated with sargassum. I recall sorting through the stomachs of a number of 2-year-old dolphins I was cleaning. Each was packed with freshly consumed 3-inch to 5-inch seahorses that had clearly come from the sargassum beds they were caught under. Yet dip netting the sargassum earlier that day, I failed to find a single seahorse.

Several years ago, I was involved in a research project in which we suspended video monitors under sargassum beds off Cape Hatteras. A surprising number of



jacks and other large fishes regularly visited the bed we were watching. Surprising too was the turnover—school after school came and went. I should add that the combination of watching underwater sloshing of the gulfweed on a small TV monitor in the cabin of a rolling research vessel was the closest I have ever come to getting seasick.

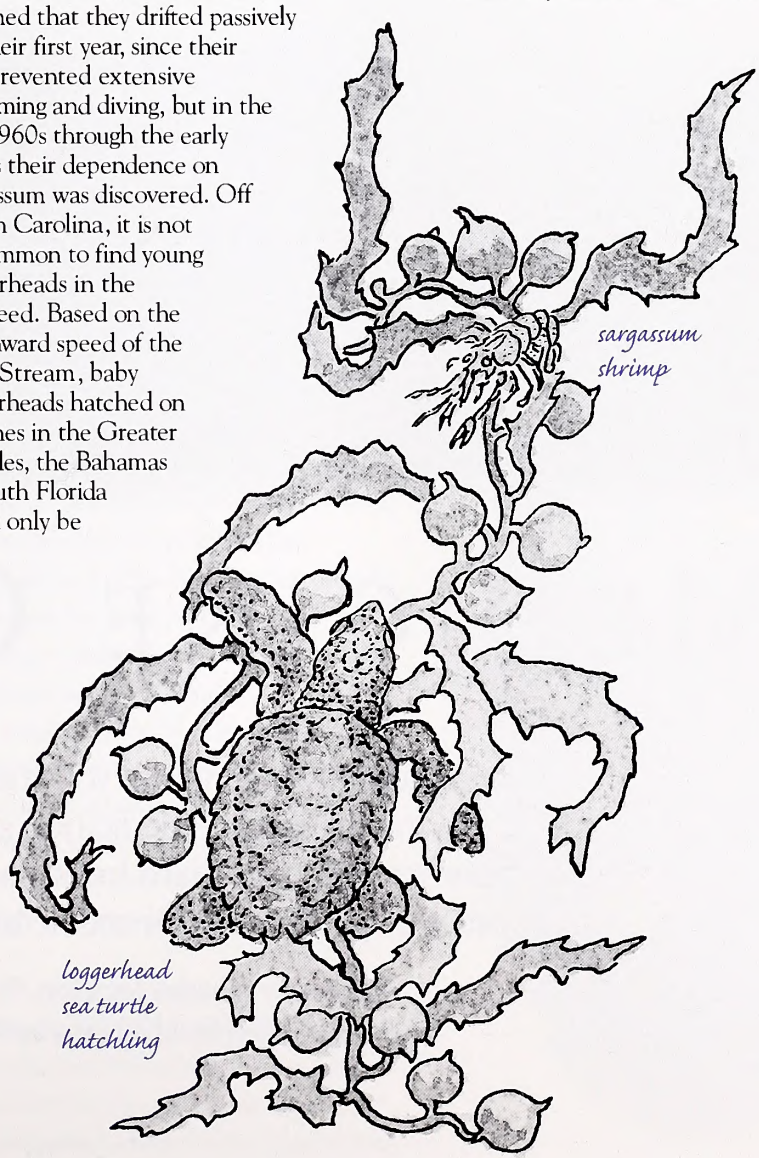
For some members of the sargassum community, the problems of a drifting, planktonic lifestyle are compounded by the need to return to fixed points of land. They must effectively cope with both the pelagic and the terrestrial worlds. Some marine turtles and several species of sea birds have particular places on land where they return to nest, but they live out their early years or their non-reproductive season following sargassum. Seabirds I see off of North Carolina freely range over extensive areas along the edge of the outer continental shelf, seeking patchy food sources along current lines and upwellings where the drifting sargassum concentrates. I found that many seabirds feed in and around the sargassum and several appear to be sargassum specialists.

Most notable of these are bridled terns, tropical pelagic birds that are nearly always associated with sargassum. Stomach analysis shows they feed largely on fishes that live in the gulfweed, with file fishes being the most common food item. Audubon's shearwaters and masked boobys spend a great portion of their time at sea feeding among sargassum, although they are not as closely tied to it as the terns. All these birds lead a nomadic existence once their nesting season is over, for the most part following drifting gulfweed beds northward from their nesting cays in the Caribbean. The summer food resources off Cape Hatteras are more dependable than those in tropical portions of the Atlantic so the birds disperse from nesting areas quickly accompanied by their young. The bridled terns, for example, are sometimes seen riding on drifting boards as they feed their begging young. As egg-laying season nears, the adults, at least, return to specific home nesting islands. The young take years to mature, and simply remain at sea near dependable food sources.

Some marine turtles are also dependent on the pelagic sargassum community. The hatchlings swim to sea and then use the algae as a place to both hide and feed. Young loggerheads and green turtles give up their pelagic existence when they are older, but for years it was unclear where neonate sea turtles went after they left their nests. Most researchers assumed that they drifted passively for their first year, since their size prevented extensive swimming and diving, but in the late 1960s through the early 1970s their dependence on sargassum was discovered. Off North Carolina, it is not uncommon to find young loggerheads in the gulfweed. Based on the northward speed of the Gulf Stream, baby loggerheads hatched on beaches in the Greater Antilles, the Bahamas or south Florida could only be several weeks old. Yet all the ones I have seen had already increased from the size of hatchlings by 20 to 30 percent. Their growth attests to the rich and predictable food resources in the sargassum.

The fish and other animals that depend on sargassum include a number of organisms of diverse origins. The majority, like the gulfweed itself, originally derived from fixed shallow-water bottom communities, a strange contrast to their adopted open-ocean life style. The perceptions of surface-dwelling animals of the open sea must be quite different from ours. Fixed reference points are nonexistent. The only real ones are the confused surface of the ocean and the angle of the sun. The earth's endless, and never fully successful, effort to redistribute heat away from the tropics carries pelagic organisms on winds and currents. The gulfweed community teaches us what we eventually come to learn—life is an opportunistic ride. ⊠

David S. Lee is curator of birds at the N.C. State Museum of Natural Sciences in Raleigh.



Our Mountain

KEN TAYLOR

Medicine Chest

Botanical ingredients are still the stalwarts in many modern medicines, and the Southern Appalachians boast the greatest number of plants used for medicinal purposes.

written by Charles Dickson ©1999
photographed by Hal Horwitz ©1999

In ancient Egypt, a citizen comes to a local physician complaining of sores on his skin. The physician advises him to put mud and moldy bread over the sores to keep them from becoming infected, and the sores will go away. In China, about 2000 B.C., a patient reports having difficulty in breathing and is told to grind up a desert shrub called mahuang and breathe its powder, and he will get better. In western North Carolina, in the 19th century, a Cherokee tribal member reports severe headaches, and the medicine man gives her willow bark to chew on, assuring her of momentary relief.

Which of the above remedies has a scientific basis? The answer: all three! The Egyptian story chronicles an early use of antibiotics to control infection; the Chinese episode portrays the use of the chemical ephedrine as a treatment for bronchial distress; and the Cherokee incident is but one small chapter in the saga of one of our most popular drugs—aspirin.

These are but three examples—and there are hundreds more—that recall how people from many different cultures and locations were able to relieve ailments long before the advent of modern science. Some remedies have been shown by scientific investigation to be ineffective, but many have survived the rigors of investigation and experience to become stalwarts of both herbal medicine and modern pharmacy. In fact, the nationally known environmental scientist and textbook author G. Tyler Miller reminds us that 40 percent of all the medications we can obtain at modern drug stores today actually have botanical origins.

The history of herbal remedies parallels the history of human beings. The use of medicinal plants to alleviate our ailments goes as far back as the beginnings of recorded history. The book of Genesis narrates the creation of the plant world on the third day, and biblical records are replete with references to the use of herbs in foods, cosmetics and medicines. Herbal history and human history are both parallel and intertwining sagas.

It's only natural that this should be the case. When pain struck, early people had little choice but to turn to plants. Of course, not all prescribed treatments were successful, and sometimes the person who began treatment as a patient ended up as a victim. Yet over long periods of trial and error, many herbal remedies were developed that were remarkably effective.

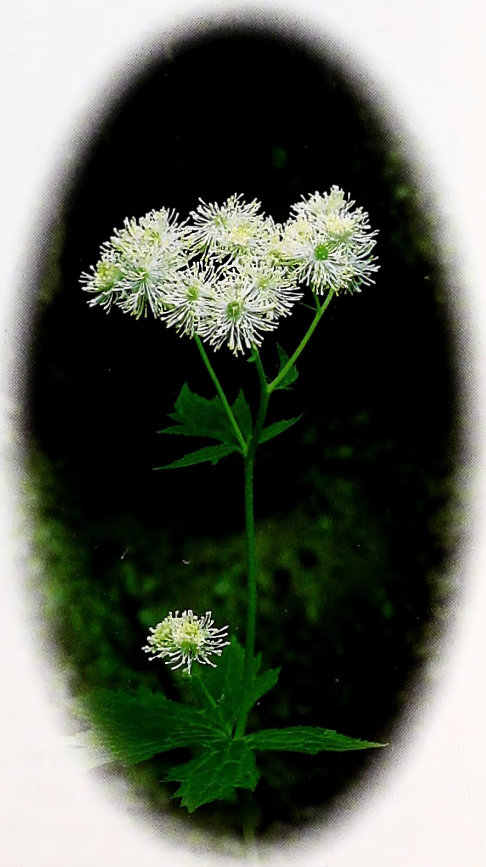
When early settlers immigrated to America and settled on the remote frontiers of the New World, there were few doctors, forcing the settlers to attend to their own illnesses. But they quickly discovered that many of the plants that had been familiar herbal remedies back home could not be found. To fill the need for these herbal medicines, businesses were established that imported seeds and plants from Europe. Many of them eventually escaped cultivation, becoming naturalized in the New World. Native Americans also had extensive knowledge of medicinal plants and often passed this knowledge on to the settlers. As American pharmacopeias developed, many native American plants were added.

Of all areas of the North American continent, the Southern Appalachians possess the largest concentration of plants used for medicinal purposes. Though any attempt at a complete listing of such plants would require volumes, a brief walk down the paths of the Southern Appalachians reveals the enormous impact of this area on modern medical practice. Let's take a walk through botany and history.

IN 1775 THE ENGLISH PHYSICIAN William Withering heard of an old woman who practiced folk medicine with herbs gathered from the countryside. This healer cured a patient afflicted with excessive fluid

goldenseal

HYDRASTIS CANADENSIS



foxglove

DIGITALIS PURPUREA

retention due to congestive heart failure, whom Withering expected to die. From the woman's bag of seeds, Withering identified foxglove (*Digitalis purpurea*) as the key ingredient in treating swelling, or edema, associated with congestive heart failure. Foxglove, native to Europe, is now cultivated throughout the Southern Appalachians. Drug manufacturers now market its active ingredient, digitalis, as a widely used medication in cardiovascular medicine.

Saint John's wort (*Hypericum perforatum*) is also native to Europe but grows throughout the eastern United States, including the southern highlands. An erect perennial shrub with bright yellow flowers, it has found extensive use as a treatment for depression in European medical practice. Some people term it the "Prozac of Europe." It is beginning to enjoy increased usage in the United States; however, caution should be exercised in its use since Saint John's wort contains hypericin, a photosensitory substance that reacts with light to cause skin burns on some people.

A traditional skin cleaner in many cosmetic preparations is witch hazel (*Hamemelis virginiana*), a bush that blooms in the autumn rather than spring and is native to the Southern Appalachians. Native Americans taught the early settlers how to make decoctions of witch hazel bark, twigs and leaves in vari-

ous strengths for use as a liniment and eyewash. It also aided in the treatment of hemorrhoids, internal hemorrhages and excessive menstrual flow. Interestingly, the name "witch hazel" developed from its reputed properties of bending toward the earth when held over underground water. Because of this property, it was used to find water by dowsers, who were also known as "water witches." Hence the popular name "witch hazel."

Still another abundant medicinal plant of the Southern Appalachians is the mayapple (*Podophyllum peltatum*), a low-growing plant having large, umbrella-like leaves with a white, inconspicuous flower and a small, greenish yellow fruit. American Indians valued it for its powerful laxative effect, as a treatment for intestinal worms, as a cure for warts and even as an insecticide for use on their crops. They also ate the mayapple's fruit and made jellies from it. A medicinal substance called podophyllum is obtained from the dried, powdered root and, compounded with tincture of benzoin, is used as a caustic for the removal of warts and benign tumors.

During the warm months of August and September, when little else blooms in the fields and hillsides, a small light blue flower known as Indian tobacco (*Lobelia inflata*) graces the landscape of eastern America. American Indians first used the plant by smoking its leaves to relieve asthma and other lung ailments. The American herbalist Samuel Thomson used it not only as a remedy for respiratory disorders but also for the relief of convulsions, to aid childbirth and as an emetic. Scientific research on the plant revealed that Indian tobacco contains a powerful alkaloid, lobeline, which is effective in treating respiratory ailments, and it continues to be used to this day in modern pharmacy.

witch hazel

HAMAMELIS VIRGINIANA

mayapple

PODOPHYLLUM PELTATUM

In early spring, in the moist rich recesses of Appalachian forests, the smooth bluish stem and large, single unfolding leaf of the blue cohosh plant (*Caulophyllum thalictroides*) stand out vividly against the surrounding barrenness. As the plant grows, it blends in with the rest of the forest growth, until in late summer the deep blue berries (which are actually seeds) attract the eye. Blue cohosh is a native American plant, growing throughout the eastern United States, including the Appalachians.

Native tribes harvested the underground parts in late fall and ground them into a powder, which they used as a remedy for rheumatism, colic, bronchitis and menstrual cramps. But they especially prized the plant as an aid in childbirth, a usage that continues to this day among practitioners of herbal medicine. There are sound experimental data that verify the effectiveness of blue cohosh in treating rheumatism.

Another plant native to the Southern Appalachians is the Oswego tea plant, sometimes called bee balm (*Monarda didyma*). The plant gets its name from the traditional story that the Oswego Indians of western New York first made tea from the dried aromatic leaves, and shared their fondness for it with colonial settlers. It was welcomed by the settlers, who went on to use it as a substitute for English tea, since the latter had become scarce following the famous Boston Tea Party. An American religious group, the Shakers, thought the tea to be effective in treating colds and sore throats, while other settlers steamed the plant and inhaled the fumes to clear sinuses.

While the plant is not used in medicine today, it has found use as an aromatic oil in the perfume industry.

Other mints found in the Southern Appalachians are peppermint, spearmint and pennyroyal. Medicinal interest in mints dates

What You Should Know about Medicinal Plants

Safety

Some plants are extremely toxic. For example, foxglove, mayapple, wild cherry, blue cohosh and lobelia are all toxic to some degree. There have been fatalities reported from the misuse of foxglove and severe reactions to other herbs mentioned in this article have also been reported. Toxicity and medicine are relative to the part of the plant used, the dosage and the quality of the herb. Proper preparation of certain plant parts is crucial to avoid toxicity. Some plant parts are toxic, others are harmless. For example, mayapple is a native medicinal that is toxic except for the mature fruit.

Conservation

Some medicinal plants are listed on the state or federal list of rare and endangered species. Goldenseal, for example, is listed by the state as an endangered-special concern species. Special concern refers to any species of plant that requires monitoring. A permit is needed to trade in this species. On the web, see also http://www.agr.state.nc.us/plantind/plant/conserv/plproact.htm

Ethical Wildcrafting

Various cultures from around the globe practice some form of herbalism. Most of the world's population still relies on traditional herbal and unorthodox medicine as the primary system of health care. This shared knowledge is still alive in Appalachia today as people harvest, prepare and sell native and naturalized medicinal plants—some call it wildcrafting—as part of their heritage or to supplement their income.

Unfortunately, the demand for native medicinals has put pressures on wild populations of certain plants. Ignorance of plant ecology and unethical harvesting has depleted populations of certain species in many areas. Ginseng (*Panax quinquefolius*) is a prime example of a native plant that is now endangered due to habitat loss and overharvesting. Other plants such as black cohosh (*Cimicifuga racemosa*), goldenseal (*Hydrastis canadensis*), blue cohosh (*Caulophyllum thalictroides*), wild yam (*Dioscorea villosa*) and sundew (*Drosera spp.*) are also at risk due to overharvesting and other pressures.

blue cohosh

CAULOPHYLLUM THALICTROIDES

Cultivation or propagation of medicinal plants is perhaps the wisest way to ensure supplies without depleting wild populations. However, some plants are very difficult to propagate and are not cost effective for commercial production. Black cohosh, for example, is difficult to propagate from seed, but relatively easy from root divisions. Goldenseal seeds can be planted immediately in the vicinity of harvest and root divisions taken from the interior of a patch can be used to increase the spread and alleviate crowding. Ethical wildcrafting should be promoted for those who rely on this endeavor for supplemental income and as part of their cultural heritage.

Public Medicinal Herb Gardens

North Carolina Botanical Garden
UNC-Chapel Hill
CB 3375, Totten Center
Chapel Hill, N.C. 27599-3375
(919) 962-0522

Cherokee Botanical Garden
Cherokee, N.C.
(828) 497-2111

Country Doctor Museum
Bailey, N.C.
(252) 235-4165

Historic Bethabara Park
Winston Salem, N.C.
(336) 924-8191

Local Medicinal Herb Information

N.C. Department of Agriculture, Herb Business Directory Website. http://www.agr.state.nc.us/markets/commodit/horticul/herbs

N.C. Department of Agriculture, Extension Specialist for Specialty Crops, Dr. Jeanine Davis (828) 648-3562. E-mail: jeanine_davis@ncsu.edu; website: http://www.ncherb.org

North Carolina Herb Association
P.O. Box 189-A
Seaboard, N.C. 27876

National Medicinal Plant Conservation Organizations

American Herb Association
P.O. Box 1673
Nevada City, Calif. 95959
(530) 265-9552

United Plant Savers
P.O. Box 98
East Barre, Vt. 05649
(802) 479-9825

The National Center for the Preservation of Medicinal Herbs
33560 Beech Grove Road
Rutland, Ohio 45775
(740) 742-4401

Medicines from the Earth
P.O. Box 3427
Ashland, Ore. 97520
(800) 252-0688

Information courtesy of Andrea Presler, curator of the Coker Arboretum, N.C. Botanical Garden; Nancy Easterling, Curator of Herbs, N.C. Botanical Garden; and Jame Amoroso, botanist with the Natural Heritage Program.

back to ancient Rome. Settlers in early New England brought the plants to America where they quickly escaped cultivation. They are found in abundance in the Southern Appalachian region. Mints have found usage in candies, liqueurs, perfumes and deodorants, as well as in medicine. One substance obtained from the mints, menthol, finds use in modern pharmacy. It is added to medications to ease the discomfort of gas.

Few wildflowers were as important to Native American tribes as the goldenseal (*Hydrastis canadensis*). Its rhizomes and roots supplied them with a brilliant yellow dye for their clothing, a paint for their faces, and remedies for inflamed eyes, mouth ulcers and edema. It may not have been effective for all of these, but its effectiveness as an antiseptic and a coagulant (to stop bleeding) is unquestionable. The flowers are actually white, but the plant gets it name from the yellow scars left on the rhizome by the stem that bursts forth every spring. These scars look like the imprint of an old-fashioned letter seal.

Goldenseal continues to be used in modern medicine. Some drug manufacturers include an alkaloid extracted from the root as an ingredient in eyedrop preparations.

Native to North America and abundant in the Southern Appalachians is the wild cherry (*Prunus spp.*). Early colonists learned of the plant's medicinal properties from Indian tribes, who used the bark to treat diarrhea and lung ailments. The colonists included the bark in cough medicines, and until 1975 it was included in the United States pharmacopeia. An extract from the bark continues to be used in both cough drops and in cough syrup preparations.

THE ABOVE REPRESENTS BUT A small slice of a much larger pie. The Southern Appalachians contains an enormous number of plants that have been and continue to be used in the healing arts. In fact, the area is such a rich source of medicinal plants that the S.B. Penick Co., a botanical drug firm headquartered in New York, maintained an office in Asheville for many years.

Since prehistoric times, humans have turned to plants for healing. The quest has not ended in disappointment. Modern pharmacy will continue to look for new sources of "green medicine," and when it does, it will surely turn to the lush forests of the Southern Appalachians. ⊠

bee balm

MONARDA DIDYMA

nature's little undertakers

Without our notice, these diminutive beetles bury the carcasses of small dead animals, helping to recycle their raw materials.

written and photographed by Harry Ellis ©1999

***A pair of burying** beetles (*Nicrophorus tomentosus*) goes about their lowly tasks. Called the grave diggers of the insect world, they inter small dead creatures in the soil by excavating the ground beneath them.*

Every living thing—human, chipmunk, fox or oriole—is born, lives for a time and then dies. Nothing organic is permanent. Out in the woods among the wild creatures, death is always close at hand. In the words of an old Indian saying, "Death, the dark mother, is always gliding near." Besides predators, wild things die from freezing and starvation, from wind and flood and storm, and from bacterial, viral and other diseases, even from old age.

To an ecologist, these deaths are not the end but rather the beginning of another necessary phase in the life of the forest. As the bodies decay, the minerals and organic compounds of which they are composed return to the earth. They become part of the soil, to be absorbed by the roots of plants in a perpetual recycling process in which nothing is ever lost or wasted. The carpets of trilliums and other wildflowers that we see brightening woodlands with their beauty are springing, no doubt, from death-rich soil, made fertile by the deaths of millions of wild creatures. Thus, a renewal of life is borne on the wings of death... or, sometimes, on the tiny legs of insects—the burying beetles of the genus *Nicrophorus*.

These orange-and-black beetles are the grave diggers of the insect world. To ensure a future food supply for their young, they bury small vertebrate carcasses by excavat-

***The loam in which** these trilliums grow is fertilized by the deaths of creatures large and small and by the role decomposers play in liberating organic matter from their bodies. Among these decomposers are the burying beetles.*

ing the soil from beneath them. In so doing, the insects display remarkable foresight and instinctive intelligence. Along with other decomposers, they are of primary importance in preventing a great accumulation of dead organic matter. Indeed, our earth teems with animal life that dies. Every woodland contains hundreds of white-footed mice, shrews, moles, chipmunks, rabbits and birds. But why do we find so few small dead animals? I hardly ever see one in my frequent outdoor excursions. A great part of the answer lies in the nighttime activities of the *Nicrophorus* beetles. They help to eliminate a potential source of pollution and to return the raw materials of which the bodies were composed more quickly to the world of life. Without such decomposers, the dead organisms would simply lie there and dry up, then take weeks or months to decay and return to earth.

When a small animal dies—perhaps a mouse, a mole, a sparrow or a chipmunk—it falls to the ground, where it may lie throughout the day. But as the earth rolls from daylight into darkness, a new world comes to life, a world of owls, bats, fireflies and whippoorwills and of many other forest animals that have waited until night to venture from hiding. As a sense of mystery steals over the woods, a pair of burying beetles—male and female—detects the smell of death on the night wind. When an animal dies, highly sensitive chemical receptors located in the beetles' antennae enable them to sense it very quickly.

The antennae of insects are amazing instruments. Covered with thousands of sensory cells, called sensilla, these organs allow burying beetles to triangulate the direction of the message and follow an olfactory beam to the location of the dead body, perhaps a mile away. If the antennae become impaired or damaged, the beetles cannot find the target even a few yards away. The nose of a bloodhound is a feeble organ compared to the antennae of these *Nicrophorus* beetles.

There are 19 species of *Nicrophorus* in North Carolina, most of them quite similar in appearance and habits. Called by various

A half dozen beetles *gather to bury this small white-footed mouse. At the beginning of their labors, the insects work in harmony, but competition soon forces most of the beetles to depart, leaving the strongest male and female behind. Once the carcass is entombed, the female lays her eggs in an adjoining tunnel. The hatched larvae feed on the decaying body of the mouse.*

common names—sexton beetles, undertaker beetles, burying beetles—they are rather handsome insects, 1 to 1½ inches in length, generally black with bright orange markings across the wing covers. There is no easy way to distinguish male from female; only *Nicrophorus* beetles know for sure.

Most species of these beetles are common and widespread. However, one species, the 1½-inch giant burying beetle (*Nicrophorus americanus*), which was common in the eastern United States a few years ago, is now quite rare and possibly near extinction. Pesticides have been blamed, but if they are responsible it is difficult to understand why only one species has declined while all the others seem to be holding their own.

When a pair of beetles arrives at a carcass, they inspect it for size. If it is too large, they reject it and leave it for other scavengers. They also inspect the ground on which it lies. If the soil is relatively soft and free from obstructions they begin to excavate beneath the body without delay, but if the ground is rocky or too hard for digging, they must move the body to a more suitable location. They find a place a foot or so away, or it may be 10 feet distant. The beetles' strength and energy are prodigious.

Other *Nicrophorus* beetles, often a half dozen or more, nearly always join the original pair. At the beginning, they all seem to work together in moving the body, but this unity is always short-lived. Fights soon break out and as the battles increase in savagery, the weaker beetles depart the scene one by one, leaving only a single dominant male and female pair. The competition for dominance ensures that the strongest male and female will mate—a definite survival advantage for the species.

The remaining male and female pair cooperates as a perfect team in moving the carcass—a white-footed mouse, for example—to its final resting place, or interring it in the ground, as the case may be. If a small twig or root gets in the way of the move, one of the beetles hastens to move it away or cut it, while the other continues with the work at hand.

With the body at the selected site, the

Thus, a renewal of life is borne on the wings of death... or, sometimes, on the tiny legs of insects—the burying beetles of the genus *Nicrophorus*.

work of interment begins at a hurried pace. Beneath the carcass the soil is undermined until the body sinks lower and lower into the grave, as the excavated earth fills in around and over it. The insects can bury an animal the size of a mouse in two or three hours. A slight rippling of the freshly turned earth indicates that the *Nicrophorus* beetles are still at work down in the dark tomb.

Away from the body, now entombed under several inches of soil, the beetles dig a side tunnel, where the female lays 25 or 30 eggs that hatch in about five days. During the first several hours of the larvae's lives, the mother regurgitates partly digested flesh that she has eaten and places a drop in the mouth of each begging larva. Like a nest of hungry baby birds, they raise the foreparts of their bodies while being fed, each offspring scrambling for position. The male also helps care for the young, taking a part in feeding them and protecting them from intruders.

The larvae are soon able to feed themselves from the decaying flesh, which 10 days later has practically disappeared, leaving only a pile of bones. Both parents remain in attendance until the young disperse to pupate in the soil—to become adult burying beetles. Having fulfilled their role in the perpetuation of the species, the parents of the new brood now leave the fetid tomb and go their separate ways.

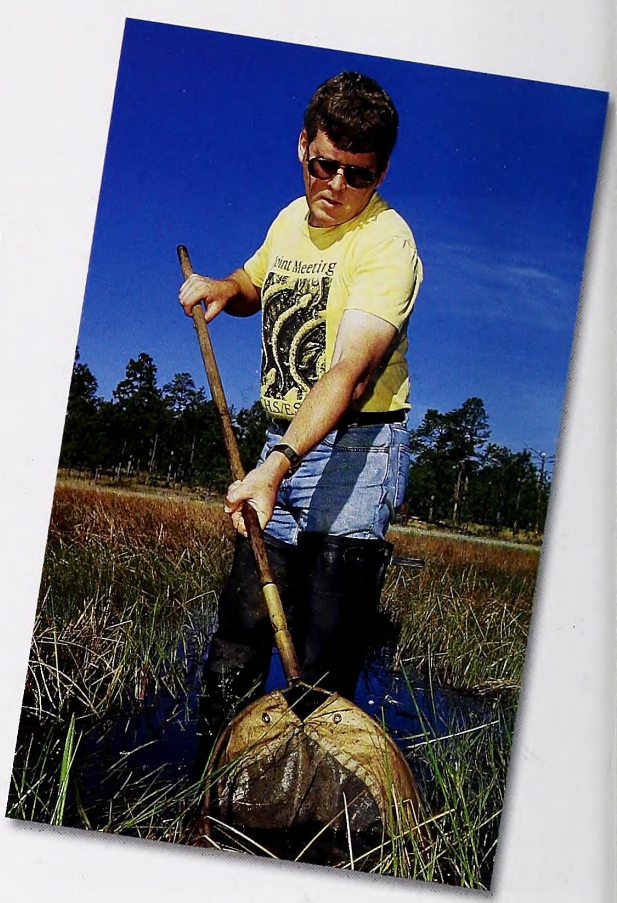
Although these *Nicrophorus* beetles look quite handsome and impressive in their bright orange and black attire, there is no denying that their association with dead animals does not endear them to humans. But repulsive as their activities may be, they perform a most useful service and form an indispensable link in the great chain of life, occupying a niche that they alone can fill.

To scientists, these beetles are highly interesting because they exhibit a very advanced form of extended parental care, in a group of insects—the beetles—where such concern for the young is almost unknown. Only among the social insects, such as ants, bees and wasps, do observers see such extended parental care. Most female insects, except for laying their eggs in a safe, secluded spot near a sufficient food supply, make no provision for either the eggs or the young, leaving them to the winds of fate. Among males, any form of parental care is practically nonexistent. Burying beetles, both male and female, display a pattern of lengthy care for the young that is truly amazing.

The apparent purposeful foresight of these insects has convinced some observers that they possess an extraordinary intelligence and even powers of reason. What people see, however, comes not from reasoning power but from the compelling urge of instinct. The brain of one of these beetles is not much larger than the head of a pin, yet within its microscopic boundary exists a summation of all the inherited patterns of behavior that the species has developed through countless ages. The realm of nature encompasses many creatures with habits and life histories that are almost incredible, but few are more fantastic than those of the burying beetles. Their world is as curious and bizarre as the world Alice discovered in her Wonderland. ⊠

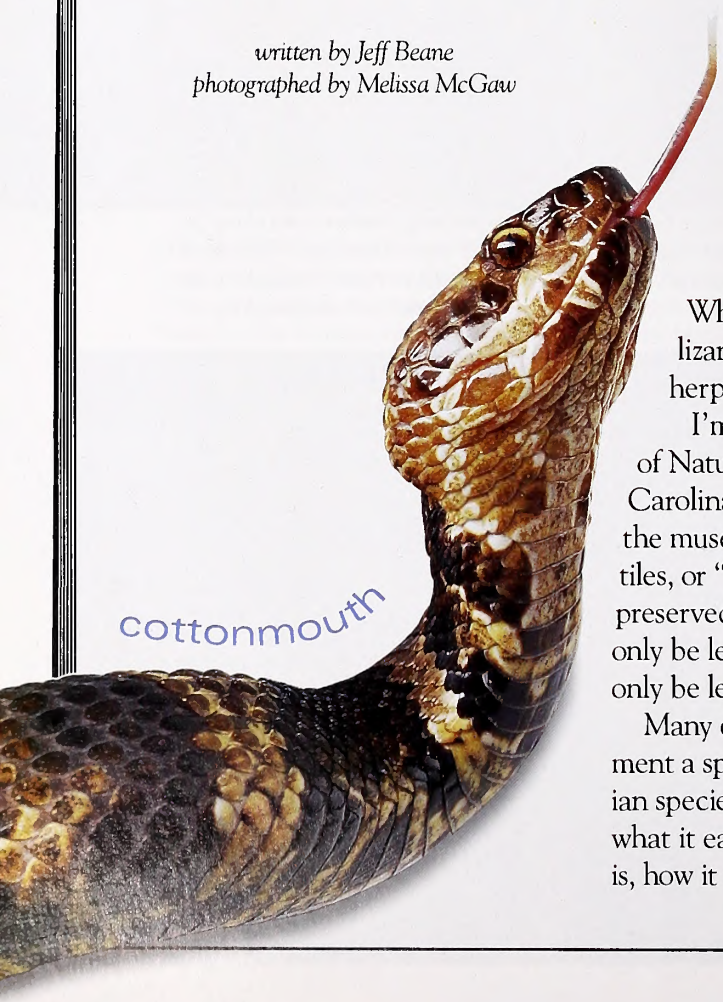
***Two burying beetles** move about on a bed of moss. There are 29 species of these beetles in North Carolina, ranging from 1 inch to 1½ inches long.*

Meet HERPETOLOGIST Jeff Beane!



As a herpetologist, Jeff Beane's job is to catch and study reptiles and amphibians all across North Carolina. In the process, he's learned to love and appreciate Nature.

written by Jeff Beane
photographed by Melissa McGaw



As far back as I can remember, I wanted to be a herpetologist. What's that? Herpetology is the study of reptiles (turtles, snakes, lizards, alligators) and amphibians (frogs, toads, salamanders), so a herpetologist is someone who studies these creatures.

I'm the Herpetology Collections Manager at the N. C. State Museum of Natural Sciences. The museum documents the natural history of North Carolina by maintaining collections and data. My job includes caring for the museum's large research collection of preserved amphibians and reptiles, or "herps," as we call them. The collection is a lot like a library, with preserved specimens instead of books. Certain things about animals can only be learned by studying preserved specimens, just as some things can only be learned by studying live animals.

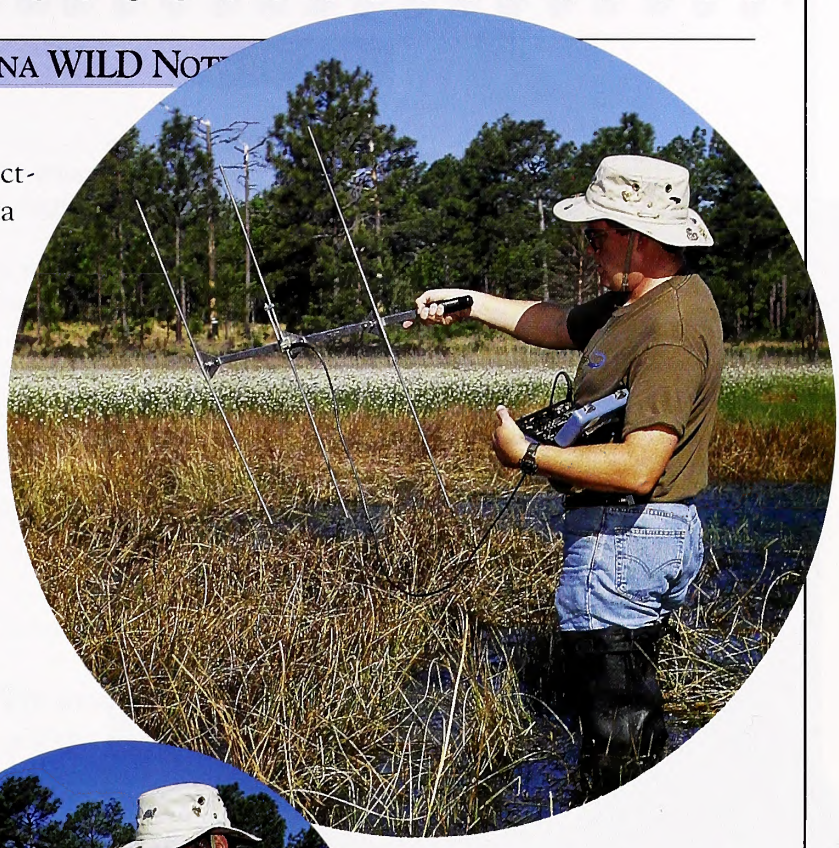
Many of the museum's specimens are maintained as vouchers, to document a species' occurrence at a certain locality. For every reptile and amphibian species in North Carolina, the museum keeps records on where it occurs, what it eats, how big it gets, how many young it has, how common or rare it is, how it varies in different parts of its range and other basic information.

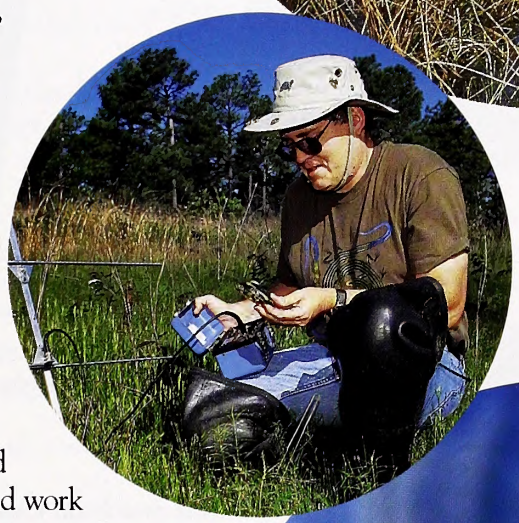
WHAT I DO

My work includes studying animals in the field; collecting, preserving and cataloging specimens; updating data files and range maps; responding to public requests for information; presenting programs; and writing and publishing articles. My job is nearly always interesting and I never get tired of it.

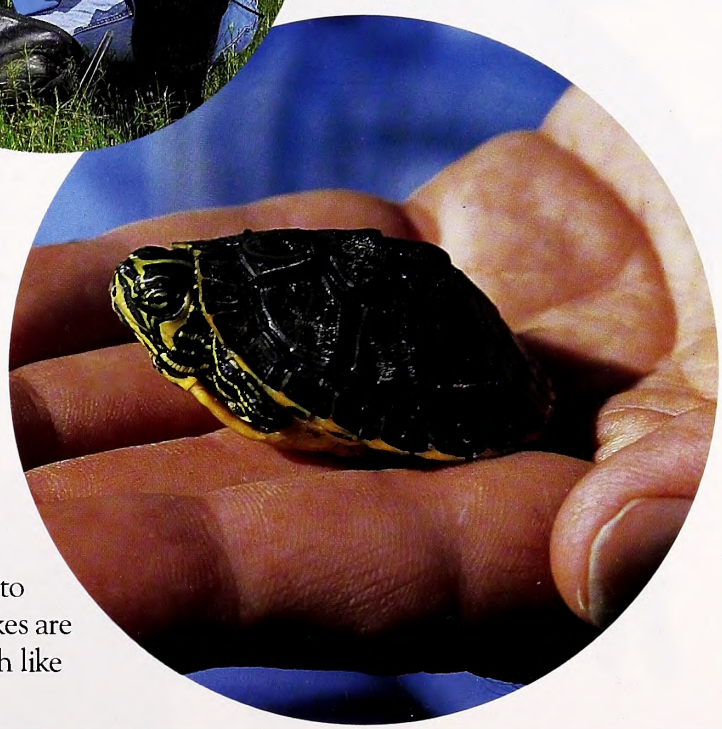
I spend a lot of time in the office and lab, but the most enjoyable part of my job is field work. I kept herps as pets when I was young, but soon realized that what they did in the wild was much more interesting and important than what they did in cages. One project I am working on is a radio telemetry study with several species of reptiles in the North Carolina Sandhills. Attaching a radio transmitter to an animal allows a researcher to follow its movements and learn about its home range, habitat requirements and activity patterns. Animals I am studying with telemetry include the chicken turtle, southern hognose snake, northern pine snake and eastern coachwhip—all of which are uncommon and declining in North Carolina.

Another project I am involved in is "Project Bog Turtle." This is a conservation effort initiated by the North Carolina Herpetological Society that helps protect the bog turtle, which is a threatened species. We locate and study populations and work to preserve habitat. I also travel all over the state collecting specimens and data and surveying herp populations.





***When he attaches** radio transmitters to turtles, frogs and snakes, Jeff can easily track them using radio telemetry. This is one way that Jeff learns about the behavior of reptiles and amphibians in the wild.*

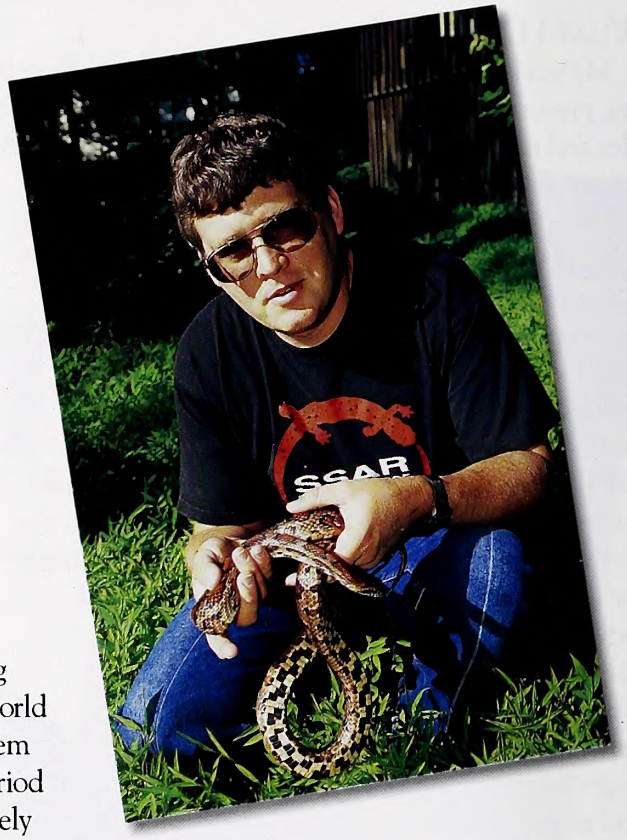


I'M NOT AFRAID OF SNAKES!

I have lived in North Carolina all my life and have been interested in its richly varied herpetofauna for as long as I can remember. Growing up, I was fascinated with the negative emotions many people felt toward these animals—especially snakes. I was taught to fear snakes, but chose instead to learn about them for myself. The more I've learned, the more I've come to love and appreciate Nature and all its components, and the harder it has become for me to understand fear or hatred of anything in Nature. To me, snakes are remarkably interesting and beautiful, and are really very much like

other animals. I've worked with venomous snakes for many years and have never been bitten. Our own activities—the cars we drive and chemicals we poison our environment with—are far more dangerous.

Sometimes people ask me what my favorite reptile or amphibian is. It would be hard to pick just one, but several of my favorites include bog turtles, hognose snakes, pine snakes, coachwhips, rattlesnakes, kingsnakes, glass lizards, gopher frogs, river frogs, barking and pine barrens treefrogs and tiger salamanders. I have a weakness for creatures that are rare or declining because of human activities, and today that includes most reptiles and amphibians.



***Though he was taught** to fear snakes as a child, Jeff chose to learn as much as he could about them. In the process, he discovered there's no good reason to be afraid of snakes. Instead, we should respect and appreciate all wild creatures including this colorful and harmless corn snake (above).*

gopher frog tadpole

CARING FOR HERPS

There are many reasons why we should care about reptiles, amphibians and all other living things. They are part of our world—part of a very complex system that developed over a long period of time and that works extremely well. It is a serious mistake to disrupt that system. We should instead make every effort to understand and respect Nature, because our own future depends upon it.

green frog

Read and Find Out

- *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*, Third Edition, Expanded, by Roger Conant and Joseph T. Collins, Houghton Mifflin Co., 1998.
- *Amphibians and Reptiles of the Carolinas and Virginia*, by Bernard S. Martof et al. University of North Carolina Press, 1980.
- *I Wonder Why Snakes Shed Their Skins And Other Questions About Reptiles*, by Amanda O'Neill, Kingfisher Books, 1996.
- *Reptiles of North Carolina*, by William M. Palmer and Alvin L. Braswell, University of North Carolina Press, 1995.
- *Frogs, Toads, Lizards and Salamanders*, by Nancy Wilson Parker, Greenwillow, 1990.
- *Amazing Snakes (Eyewitness Juniors)*, by Alexandra Parsons, Jerry Young (Photographer), Random Library, 1990.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

Living Research: Aquatic Heroes and Heroines: teaches students about the accomplishments of local people who have helped to conserve aquatic environments.

Which Niche? Teaches students to define ecological niches by comparing them with careers in their community.

Wildlife Research: Teaches students to identify reasons for research related to wildlife and to design and to conduct a wildlife research project.

Wildwork: Teaches students to name and describe three wildlife occupations.

Get WILD

Aug. 17-19 – *WILD Workshop*, Coastal Carolina Community College, Jacksonville, (910) 938-6294.

Aug. 17-18 – *WILD Workshop*, Wayne County Agriculture Center, Goldsboro. Tricia Scott, (919) 731-1527.

Aug. 24-26 – *WILD Workshop*, Hanging Rock State Park, Danbury, Jaye Dow, (336) 593-8480.

Sept. 7, 9, 14 – *WILD Workshop*, Catawba Valley Community College, Hickory, Louise Garrison, (828) 327-7000, Ext. 326.

***Herpetologists don't** spend every day outside catching snakes and frogs. Jeff spends plenty of time inside his office at the N.C. State Museum of Natural Sciences in Raleigh caring for the museum's large collection of preserved specimens.*

What Does It Mean?

herpetology: the study of reptiles and amphibians

vouchers: specimens used to document or prove that a certain species occurs in a certain area

radio telemetry: a method of tracking wild animals by implanting them with transmitters and using a receiver to locate their signal

radio transmitter: a small device that emits a radio signal which can be picked up by a receiver and used to locate animals

chicken turtle: a rather uncommon aquatic turtle with a very long neck, found in the Coastal Plain of North Carolina

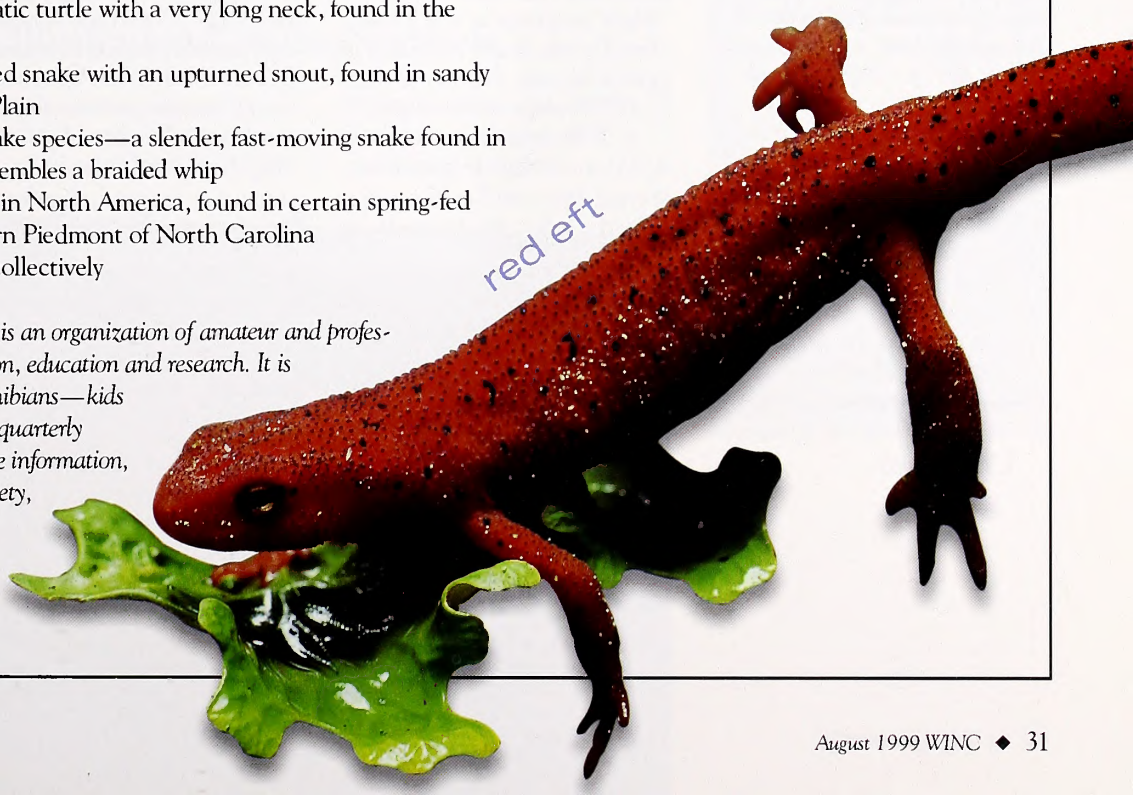
southern hognose snake: a small, spotted snake with an upturned snout, found in sandy areas of the North Carolina Coastal Plain

coachwhip: North Carolina's longest snake species—a slender, fast-moving snake found in the southern Coastal Plain; its tail resembles a braided whip

bog turtle: the smallest and rarest turtle in North America, found in certain spring-fed wetlands in the Mountains and western Piedmont of North Carolina

herpetofauna: reptiles and amphibians, collectively

The North Carolina Herpetological Society is an organization of amateur and professional herpetologists dedicated to conservation, education and research. It is open to anyone interested in reptiles or amphibians—kids included. Jeff Beane has edited the society's quarterly newsletter, NC Herps, since 1986. For more information, contact North Carolina Herpetological Society, N.C. State Museum of Natural Sciences, P.O. Box 29555, Raleigh, N.C. 27626-0555, or call (919) 733-7450, Ext. 754.



Deer-Related Vehicle Accidents on the Rise in North Carolina

JACK DERMID

***Scenes like the** one above are becoming all too common in North Carolina, as the state's traffic increases. The majority of deer-related traffic accidents are occurring in the eastern half of the state. In Hyde County, deer were involved in two out of every five accidents in 1997.*

Deer cause more than 5 percent of all reported driving accidents throughout the state, according to a University of North Carolina analysis of 1997 motor vehicle accident records.

Although they cause few injuries compared with other crashes, deer-related mishaps are increasing by more than 10 percent a year since 1994, often resulting in extensive body damage to cars.

"This is without a doubt an underestimate since records are generated only when police officers write reports about crashes and include the word 'deer' in them," said Donald Reinfurt, deputy director of the UNC Highway Safety Research Center. "Many accidents in which deer played a role simply are not reported because there's less than $1,000 damage and no injury."

In 1994, police reported about 8,000 automobile accidents involving deer, said Reinfurt, who helped conduct the research. In 1997, officers reported 11,129. Complete records for last year are not available. Some North Carolina counties, especially in the mountains, had few accidents involving deer in 1997, he said.

Eastern counties showed the most. In Hyde County, for example, deer were involved in 40 percent of automobile accidents. Other counties with high deer-related accident rates included Caswell, Tyrrell, Franklin, Jones, Greene, Bertie, Warren and Chatham. Those with the lowest accident rates were Graham, Haywood, Jackson, Buncombe, Swain and Mecklenburg.

Half of the deer-related accidents occurred in the last quarter of the year during fall and early winter. Also, half happened on county and local roads, a quarter on state roads, and only a small percentage on U.S. routes and interstates and in towns. Nearly three-fourths occurred between 6 p.m. and 6 a.m.

"Only about 8 percent of these accidents caused injuries to the driver or passengers, while more than 45 percent of non-deer crashes resulted in injuries," Reinfurt said. "Still, we recommend that people drive more slowly at night where deer are likely to be, and if you see one run across the road, slow down because usually others are in the vicinity."

North Carolina's deer population now stands at about 900,000, said Carl Betsill, research and regulation section manager for the N.C. Wildlife Resources Commission. In 1910, only 10,000 deer roamed the state, and in 1975 there were about 250,000.

Besides the 175,000 deer taken by hunters in 1997, unknown thousands of others die after being hit by cars and trucks.

"I estimate that the 400 to 600 deer we know are killed on highways each year represent only about 10 percent of the total," said Scott Osborne, big game program coordinator for the Wildlife Commission. "In a lot of accidents, deer are not killed and often not even injured."

Peak months for deer movement are October, November and December. Normally gregarious, bucks become aggressive and territorial during the fall rut, driving away younger bucks, Osborne added.

"Between summer and fall, the deer diet changes as well," Osborne said. "They go from eating mainly grass and leaves to acorns, corn and other crops. That carbohydrate diet gives them more energy and makes them more active."

—Courtesy of UNC News Services

Editor's note: *The N.C. Wildlife Resources Commission recognizes the growing problems with deer-related traffic accidents. With a few precautions, however, motorists can greatly reduce the odds of hitting a deer.*

1. Deer are most active at daybreak and dusk and on dark overcast or foggy nights. Motorists should reduce their speed during these times, especially in areas known to be frequented by deer.
2. Drive with headlights on high beam when possible. Watch for eyes reflecting in your lights when near field edges or posted crossings. If you see deer, immediately reduce your speed, even though the deer may be a considerable distance from the road. Your headlights may cause them to panic and run at anytime.
3. If you see a deer cross the road in front of you, slow down and watch for other deer that may be waiting to cross behind it.
4. Don't rely solely on "deer whistles" or other "ultra-sonic" devices claiming to prevent deer collisions. North Carolina wildlife biologists are aware of no scientific evidence that these devices are effective.
5. Support legal and ethical hunting as a means of maintaining deer populations at a level that can be enjoyed by all.

Edited by Chris Powell

John Hatcher's Passing Honored by Memorial Fund

John Hatcher, of Garner, spent a short time on earth, but with an enduring love for nature and wildlife.

A memorial fund was recently established with the N.C. Wildlife Resources Commission in memory of John who, a year ago, died at age 14 in a traffic accident. Through the fund, more than $2,000 has been allocated for the future development of the Wildlife Commission's Hunter Safety Program at Camp Millstone, in Ellerbe.

To recognize those contributions, the Wildlife Commission recently hung a plaque honoring John at the John Lentz Center, located in Camp Millstone. It was a tribute truly befitting a boy who loved hunting, fishing and nature, said Julie Hatcher, a close relative.

"After taking the Hunter Safety Course at age 12, John recognized his calling," Hatcher said. "The desire to protect and respect wildlife came naturally for him and becoming a wildlife officer was one of his goals. Though his father sparked an interest in the outdoors, his genuine admiration and regard for wildlife were intuitive."

Tax-deductible contributions may be sent to the John Hatcher Memorial Fund, care of the N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27604.

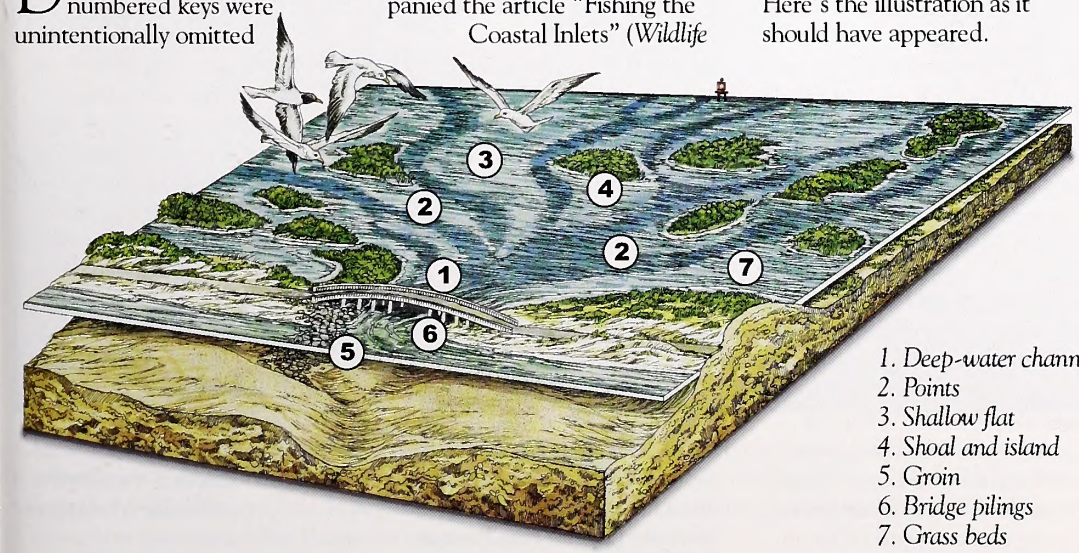
—*Chris Powell*

HATCHER FAMILY

***John Hatcher, a Garner youth** who died recently in a traffic accident, poses with a 6-point buck he harvested in Martin County in 1996. Because of his love for wildlife, a memorial fund was established with the N.C. Wildlife Resources Commission in John's honor.*

Whoops! Inlet Illustration Lost Its Numbers

Due to a printing error, the numbered keys were unintentionally omitted in the illustration that accompanied the article "Fishing the Coastal Inlets" (*Wildlife in North Carolina*, July 1999). Here's the illustration as it should have appeared.



1. *Deep-water channel*
2. *Points*
3. *Shallow flat*
4. *Shoal and island*
5. *Groin*
6. *Bridge pilings*
7. *Grass beds*

On Patrol

Editor's note: *Though most North Carolina sportsmen are law-abiding, a few are not. Listed below is a report of a wildlife violation that exemplifies the humorous, and at times bizarre, situations our North Carolina wildlife enforcement officers encounter while on patrol.*

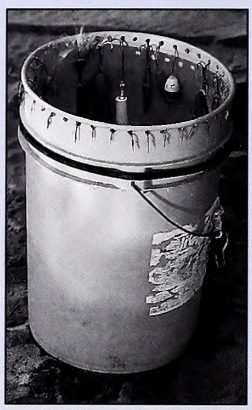
Wildlife Officer Toby Jenkins was assisting the Polk County Sheriff's Department during an investigation of a domestic disturbance, when the estranged wife noticed Jenkins was a wildlife officer. She quickly pointed out a 12-inch beard belonging to a turkey she said her husband killed last fall. There being no fall turkey season in North Carolina, Jenkins asked the woman if she had a photograph of the bird, and she retrieved one showing her husband holding a bird against what was clearly a background of fall foliage.

When confronted with the picture, the husband asserted that the bird was taken during the spring, and he could not explain the photograph's fall appearance. The quick-thinking Jenkins then asked the man, "Well, how do you explain the turkey also being in his fall plumage?" The man then confessed to taking the turkey in the fall, not realizing that he had just been out-foxed.

Outdoor Tips

Saltwater Tackle Box—One of the best tackle boxes ever invented for saltwater fishing is nothing more than a plastic, 5-gallon bucket. By drilling holes around its rim, you can keep lures, hooks and leaders from tangling. If you use the bucket in a boat, drill a few small holes in the bottom to prevent the bucket from filling with sea spray.

—Joel Arrington, Raleigh



JOEL ARRINGTON

Editor's note: *Do you have a tip or suggestion you would like to share with our readers? If so, please write Chris Powell at 512 N. Salisbury St., Raleigh, N.C. 27604; Fax: (919) 715-2381; E-mail: (powell.chris@coned.wildlife.state.nc.us)*

Tags No Longer Required for Big Game Harvests

Hunters will not be required to tag deer, wild turkey, bear and wild boar as a result of a recent rule change approved by the N.C. Wildlife Resources Commission for the 1999-2000 season.

Instead, all hunters will be required to note their harvests on a Big Game Harvest Report Card, which will be issued to each hunter upon purchase of a hunting license. Report cards will automatically be mailed to lifetime license holders. Also, free report cards will be made available to individuals exempt from hunting license requirements.

The new rule requires hunters, before removing a downed animal, to cut a notch from the space on their report card that indicates the animal's sex and species. Also, within 24 hours and before dressing an animal, hunters must obtain a Kill Report Authorization Number and write it on the space adjacent to the notched portion of the card. The authorization number can be obtained either by transporting the animal to a cooperator agent or by calling the toll-free telephone-reporting system (1-800-I-GOT-ONE). The authorization number must then be written in the space adjacent to the notched portion of the report card.

LEONARD LEE RUE, III

Animals may be field dressed prior to obtaining an authorization number; however, the species and sex of the animal must be identifiable. The Big Game Report Card for the 1999-2000 season will have spaces to record six deer, two wild turkeys, two boar and one bear.

"The data we receive from hunters' report cards are crucial to ensuring that our various game species remain a viable resource for years to come," said David Cobb, chief of the Commission's Division of Wildlife Management. "Based on reported harvests, we can gauge the status of a species' population before setting bag limits for the following season."

It's also the law. Failure to properly register a big game animal can result in a $25 fine plus $85 court cost.

—Bodie McDowell

Nominees Sought for Wildlife Management Awards

No government agency can ever completely address the complex array of issues affecting wildlife such as quail, cottontail rabbits and waterfowl. Often, management efforts are a result of biologists working with landowners, agricultural agents, businesses and nonprofit organizations, who then voluntarily promote wildlife habitat.

To recognize this teamwork, the N.C. Wildlife Resources Commission is accepting nominees for the Small Game Awards Program and the Waterfowl Conservation Award Program. Each award has two categories —individual and organization/business—and the top candidates for each will have achieved outstanding results developing habitat for bobwhite quail, cottontails, songbirds or waterfowl.

Nominations will be accepted through Sept. 1, 1999. Applications for nominees can be obtained by writing: N.C. Wildlife Resources Commission, Division of Wildlife Management, Raleigh, N.C. 27604, or calling (919) 733-7291. The applications for each program will be evaluated by the Small Game and Waterfowl committees.

Statewide winners will be recognized at the January meeting of the Wildlife Commission.

"Private individuals are often key players in our programs through their individual management efforts and by serving as catalysts to bring about change," said Carl Betsill, section manager for the Wildlife Commission's Division of Wildlife Management.

—Courtesy of the Division of Wildlife Management

North Carolina Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

Aug. 14

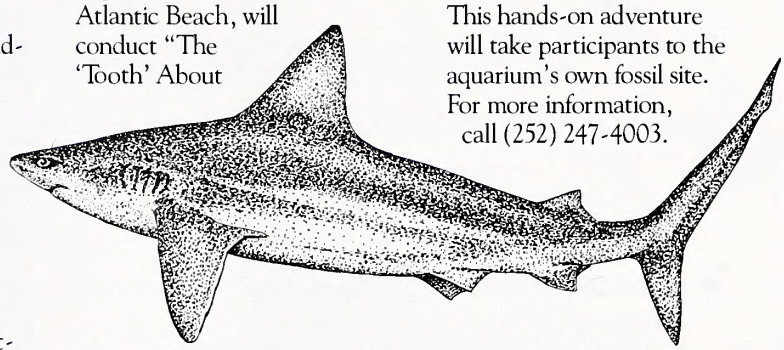
The Pisgah Center for Wildlife Education, located near Brevard, will conduct a wildflower identification program from 9 a.m. to noon. Beginners ages 16 and up will learn to identify late-summer wildflowers using *Newcomb's Wildflower Guide*. The guide will be available for purchase at the center. For more information, call (828) 877-4423.

Aug. 28

The Pisgah Center for Wildlife Education, located near Brevard, will conduct the "Splish Splash – Water Quality & Streamlife" program from 9 a.m. to noon. This program teaches the identification of stream critters, and participants will build their own collecting net and use it to collect aquatic organisms. Participants should wear shoes that can get wet. For more information call (828) 877-4423.

Aug. 5 and 26

The Pine Knoll Shores Aquarium, located in Atlantic Beach, will conduct "The 'Tooth' About Fossils" program. Dig into the past and learn about creatures that lived in the oceans. This hands-on adventure will take participants to the aquarium's own fossil site. For more information, call (252) 247-4003.



Winston-Salem Youth Wins Commission's Writing Contest

GLENN PERRYMAN

Chuck Price, 16, of Winston-Salem, holds a plaque *he received for winning the N.C. Wildlife Resources Commission's statewide Personal Code of Ethics writing contest. Price is accompanied (from left) by his teacher Glenn Perryman; Stanley Elrod, principal of R.J. Reynolds High School; his mother Helen Price; and Wildlife Commission lieutenants Mike Bogdanowicz and Randy Barker.*

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through May 1999

Principal Balance
$27,872,079.91

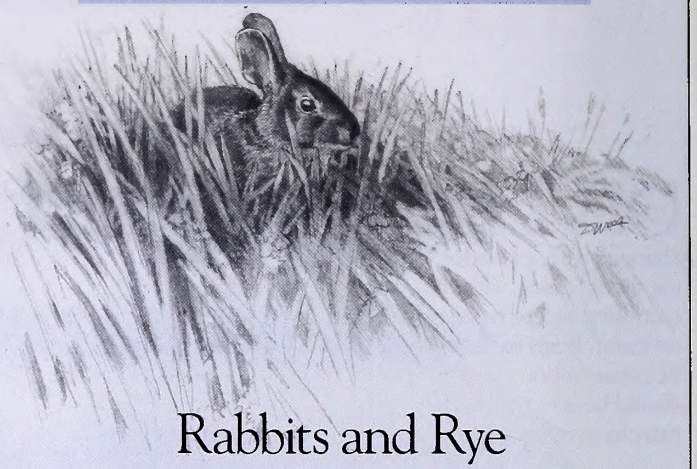
Interest Earned
$28,226,919.23

Total Receipts
$56,098,999.14

Interest Used
$17,270,819.04

Fund Balance
$38,828,180.10

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.



Rabbits and Rye

by Rodney Foushee

Sure, the heat of summer is upon us, but there are still plenty of things you can do for wildlife on your property.

Counting Rabbits: The end of summer is a good time to take a census of rabbits on your land. Conduct counts during the early morning or evening when rabbits are most active. Rabbits tend to concentrate in fields, along roads and other open areas just after a light rain.

Besides the actual number of rabbits you count, be careful to notice the size of rabbits on your land. If you spot rabbits in a variety of sizes, chances are they've been successfully breeding all summer long. If all the rabbits are the same size, however, breeding was probably successful during only one period.

Though in no danger of disappearing in North Carolina, rabbits and other small game are not as plentiful as they once were. Loss of habitat through modern farming and urbanization is the major culprit. If rabbits are scarce on your property, you may need to do some habitat improvement work of your own. For more information about the life history of rabbits and increasing their numbers on your land, request the free booklet, *North Carolina Rabbits: Natural History and Management*, from the N.C. Wildlife Resources Commission by calling (919) 733-7291.

Planting Rye: If you want to provide deer and other wildlife with a good source of winter forage on your farm or hunt club, consider planting rye. The last week of August is the best time to seed rye in the Piedmont and Mountains, with the first two weeks of September optimal for planting rye in the Coastal Plain. Though a seed drill can be helpful for large plantings, simply broadcasting the seed by hand or with a small rotary spreader is fine for small rye food plots.

The Upland Gazette: If you're really interested in the future of rabbits and other small game in North Carolina, the Wildlife Commission has a newsletter for you. Published three times a year, *The Upland Gazette* is dedicated to the management and conservation of quail, rabbits, doves, grouse and squirrels. Subscriptions to *The Upland Gazette* are free to anyone interested in small game.

To be placed on the mailing list for *The Upland Gazette*, call the Division of Wildlife Management at (919) 733-7291.

N.C. WILD STORE

Don't Forget **Your** Back-to-School **Wildlife Power Pack!**

Fact: School starts soon. Another year of student projects on North Carolina's wildlife is creeping nearer. This year, order educational materials from the N.C. WILD Store to build a home wildlife library with a North Carolina focus. Here's what you can get:

1 *The big picture about North Carolina's habitats.* **North Carolina WILD Places: A Closer Look** has it all—it's a book that covers 13 of the state's major wildlife habitats and the ways fish and wildlife are adapted to them. The illustrations are wonderful! And three **posters** come with it.

2 *Information on individual species.* Remember how long it took your daughter last year to discover whether black bears sleep through North Carolina's mild winters? The **WILDlife Profiles & Binder** contains 120 fact sheets about everything from white-tailed deer and largemouth bass to spring peepers and monarch butterflies.

3 *Knowledge about how species interact.* The illustrated articles in the **Nature's Ways** books show the amazing ways that North Carolina's animals live together in their habitats.

4 *Posters for the young scholars'.* How about the **Reptiles of North Carolina** and the **Amphibians of North Carolina**?

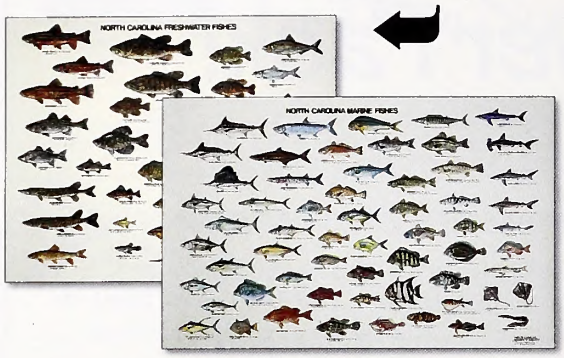
A **Wildlife Power Pack** is just what you need for the new school year. Look for the **apple symbol** inside!

More terrific items ☛

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

North Carolina's freshwater fish and marine fish are colorfully displayed on individual posters, and feature the art of Duane Raver. Reel yours in today!



FISHES OF NORTH CAROLINA
Set of 2. Freshwater fish poster shows 36 state species (size 28" x 22½"). Marine fish poster shows 60 species (size 35" x 22½") $10.
ITEM CODE **P9**

NATURE'S WAYS COLLECTION
Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50.
ITEM CODE **M9**

Also available as a boxed set. $30.
ITEM CODE **M10**

Before going on your next outdoor hike or camping trip, be sure you know North Carolina's reptiles.

REPTILES OF NORTH CAROLINA
Set of 4 posters in full color. Each poster decribes the species and denotes which reptiles are on the endangered, protected or special concern list. A set includes: lizards, turtles, and both live-bearing snakes and egg-laying snakes. Posters are sized 22" x 34". $18. ITEM CODE **P10**

AMPHIBIANS OF NORTH CAROLINA
The Hylid Frogs. North Carolina's tree frogs, cricket frogs and chorus frogs, belonging to the large family *Hylidae*, are presented in this colorful poster, one of two frog posters in the Amphibians series. 22" x 34". $6.
ITEM CODE **P11**

AMPHIBIANS OF NORTH CAROLINA
True Frogs and Toads. The second poster in the Amphibians series showcases true frogs and toads. Vibrant photos combine with informative text to make it a standout in the classroom or at home. 22" x 34". $6.
ITEM CODE **P14**

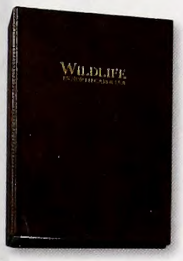
WATERFOWL DECOYS OF N.C.
Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.
ITEM CODE **P12**

TRADITIONAL TROUT FLIES OF THE SOUTHERN APPALACHIANS
Sixteen traditional trout flies are presented in stunning color detail. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. Second in a series of "Sporting Heritage" posters. 22" x 34". $10. ITEM CODE **P13**

BIRD HOUSES & FEEDERS: HOW TO BUILD AND ENJOY THEM
An eight-page illustrated guide to building bird houses and feeders. $2.
ITEM CODE **M6**

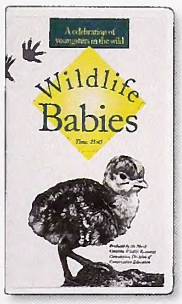
Dogs that Point, Fish that Bite

Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. $19.95. ITEM CODE M8



Magazine Binder

Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. $10.
ITEM CODE M2



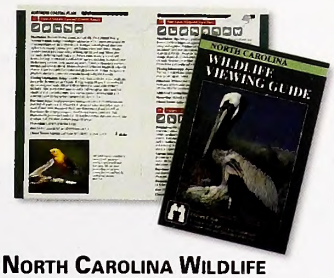
Wildlife Babies Video

Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others . $20.
ITEM CODE N9

Based on Chief Seattle's 1855 speech, the film's focus is on environmental ethics. Accompanied by This Land Is Sacred, this film is a must-see for everyone. It is destined to become a classic.

All Things Are Connected

Video and Activity Guide. $22.
ITEM CODE W3



North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. $5.95. ITEM CODE N6

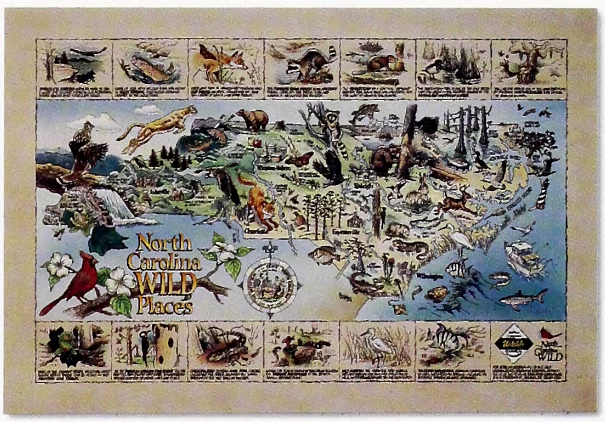
Gardens for Butterflies

Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. $2. ITEM CODE M5

Scouting Correlations

Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each $3.
Cub & Boy Scout Correlation. ITEM CODE E9
Girl Scout Correlation. ITEM CODE E10

North Carolina's wildlife habitats come alive in this 82-page, easy-to-read, soft cover book. With delightful illustrations by Anne Marshall Runyon, N.C. WILD Places covers 13 habitats across the state.



North Carolina WILD Places: A Closer Look

Book and Posters Set. With each book you'll receive two habitat posters (also by Runyon) and a N.C. WILD Places Map poster, featuring the art of Jackie Pittman. $16. ITEM CODE E6

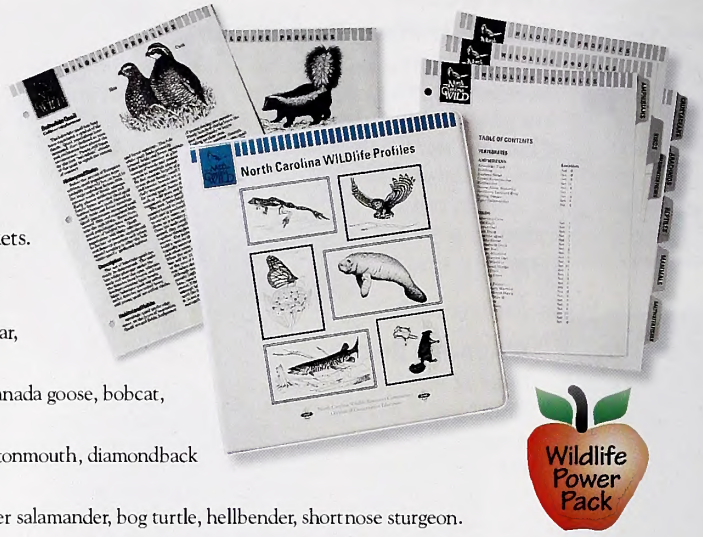
North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. $6.
ITEM CODE E7

More terrific items ☛

N.C. WILD STORE

Top-quality, 3-ring binder holds 120 WILDlife Profiles. Custom-made binder comes with a table of contents, tab dividers to organize Profiles by classes, an index and 120 fact sheets.



WILDlife Profiles Binder & WILDlife Profiles Sets 1-12

Binder features clear overlay cover, 1½" capacity and inside literature pockets. See the list of species profiled below. $30. ITEM CODE W17

Wildlife Power Pack

Set 1. Black bear, raccoon, white-tailed deer, striped skunk, bobwhite quail, wild boar, muskrat, mourning dove, coyote, mallard.

Set 2. Mink, canvasback duck, red fox, wild turkey, beaver, American river otter, Canada goose, bobcat, red wolf, cougar.

Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass.

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster.

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat.

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad.

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish.

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet.

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet.

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.

INVENTORY BLOWOUT!

50% off if you order Sets 1 through 10 inclusive. $10. ITEM CODE W4-S
Discount does not apply to purchase of individual sets. Time-limited offer expires Dec. 31, 1999.

Wildlife in N.C. Caps

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE A3

Blaze orange and camouflage hats are embroidered with magazine logo and buck deer silhouette. **$16.50 each.**

Blaze orange with brown waxcloth bill. ITEM CODE A7

Advantage® Camouflage with tan suede bill. ITEM CODE A6

N.C. WILD Cap

N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50.
ITEM CODE A1

100% cotton (preshrunk) T-shirts are guaranteed for comfort and durability. Each shirt features an original design.

Pisgah Center for Wildlife Education T-shirt

Colorful Pisgah Center logo on back. Natural. $14.50.
ITEM CODES:
A8MED (medium)
A8LRG (large)
A8XLG (extra large)
A8XXL (extra extra large)

Wildlife in N.C. T-shirt

WINC magazine logo on front pocket. Tundra swan art on back. White. $14.50. ITEM CODES:
A5MED (medium)
A5LRG (large)
A5XLG (extra large)
A5XXL (extra extra large)

N.C. WILD T-shirt

N.C. WILD logo printed on front and colorful art on back. White. $14.50. ITEM CODES:
A4MED (medium)
A4LRG (large)
A4XLG (extra large)
A4XXL (extra extra large)

WILDLIFE COMMISSION

SPOTLIGHT

Providing Universal Access

Though able-bodied sportsmen may take access to their favorite river or lake for granted, just getting to the water's edge can be a major challenge for disabled boaters and anglers. That's why the N.C. Wildlife Resources Commission is working hard to provide universal access to its many boating and fishing areas across the state.

Everyone—no matter what their level of physical ability—can enjoy fishing and boating. The key is to remove barriers that limit access to the water. To meet this goal, the Wildlife Commission has changed its design standards for all new Boating Access Areas to provide barrier-free access. Fully accessible boat ramps include disabled user parking, paved walkways and barrier-free docks.

The Wildlife Commission also provides universal access to fishing areas across the state with piers and paved walkways to allow wheelchair-bound and blind anglers a chance at a variety of fish.

As existing boating and fishing areas are renovated, additional barriers will be removed when possible. Such improvements can include: elimination of steps, designation of handicap parking, installation of paved walkways, piers and non-slip ramps.

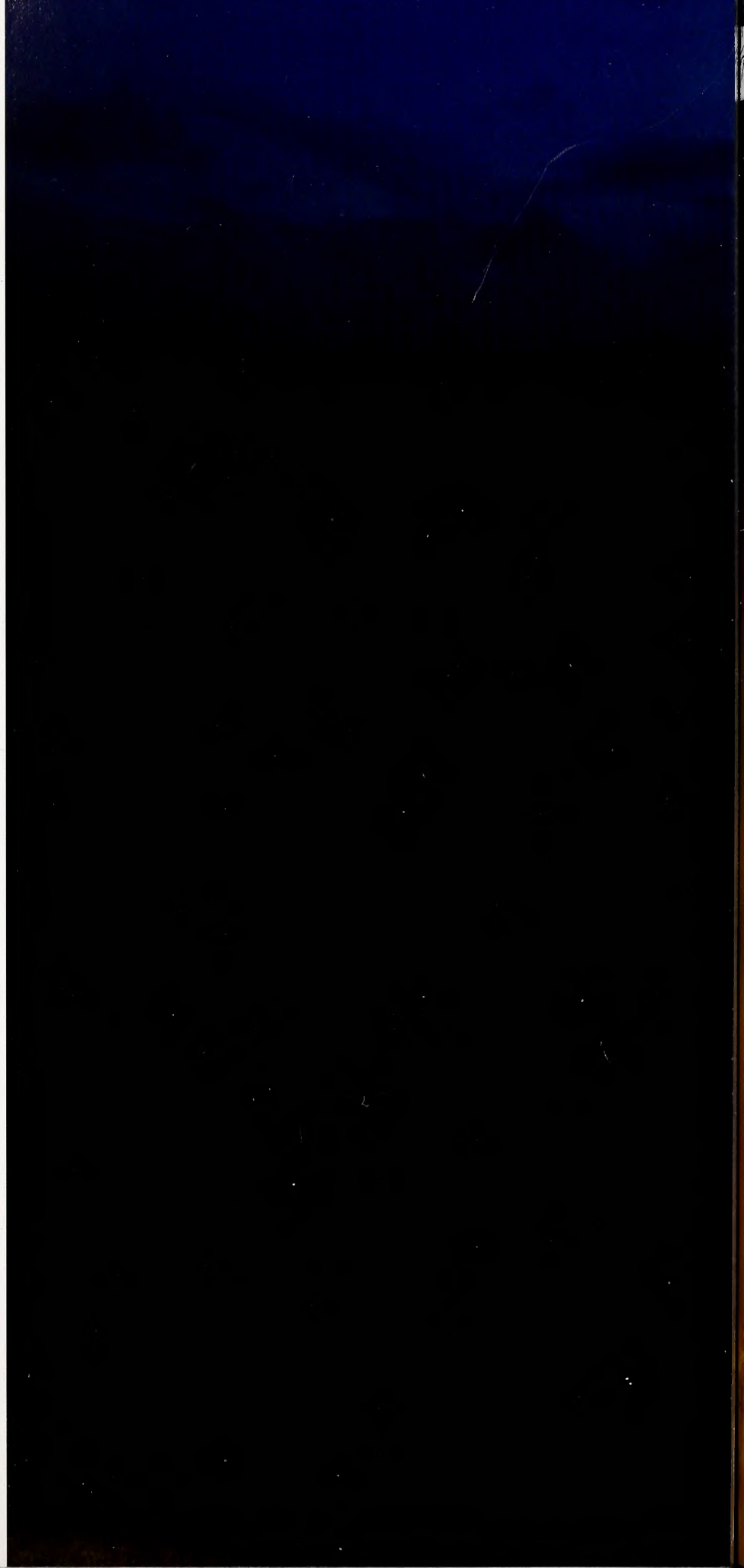
Suggestions? The Wildlife Commission wants everyone to enjoy boating and fishing. So, if you have a problem accessing a specific boating access area and would like to suggest improvements, call (919) 715-3155. For suggestions or more information about universal fishing access, call (919) 733-3633.

KEN TAYLOR

ROGER I. JONES

Fully Accessible Boating Access Areas

Body of Water	Location	Access Name
Blewett Falls Lake	Anson Co.	Pee Dee
Brice's Creek	Craven Co.	Brice's Creek
Chowan River	Gates Co.	Shoups Landing
Croatan Sound	Dare Co.	Bowsertown Road
Hickory Lake	Caldwell Co.	Gunpowder
Alexander	Whittenburg	
Catawba	Oxford	
Intracoastal Waterway	Brunswick Co.	Oak Island
New Hanover	Wrightsville Beach	
Carteret	Morehead City	
Kerr Lake	Vance Co.	Flemingtown Landing
Lake James	McDowell Co.	Black Bear
Lake Rim	Cumberland Co.	Lake Rim
Lake Santeetlah	Graham Co.	Cheoah Point
Lake Tillery	Montgomery Co.	Swift Island
Montgomery	Lilly's Bridge	
Meherrin River	Hertford Co.	Murfreesboro
N. Landing River	Currituck Co.	Poyners Road
Pantego Creek	Beaufort Co.	Belhaven
Rhodhiss Lake	Burke Co.	Rhodhiss
Caldwell	Conley Creek	
Roanoke Rapids Lake	Halifax Co.	5th Street Landing
Roanoke River	Washington Co.	Plymouth
Roanoke Sound	Dare Co.	Washington Braum Br.
Scuppernong River	Tyrrell Co.	Columbia
Sutton Lake	New Hanover Co.	Sutton Lake
Tranter's Creek	Beaufort Co.	Mason's Landing
Trent River	Jones Co.	Pollocksville



Ease Her In

As the setting sun colors the horizon of Pamlico Sound, this angler strains against the weight of a nice-sized red drum. Once common, the red drum is in trouble today. Story on page 8.

Periodicals postage paid at
Hickory, North Carolina

LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
CONOVER, NORTH CAROLINA

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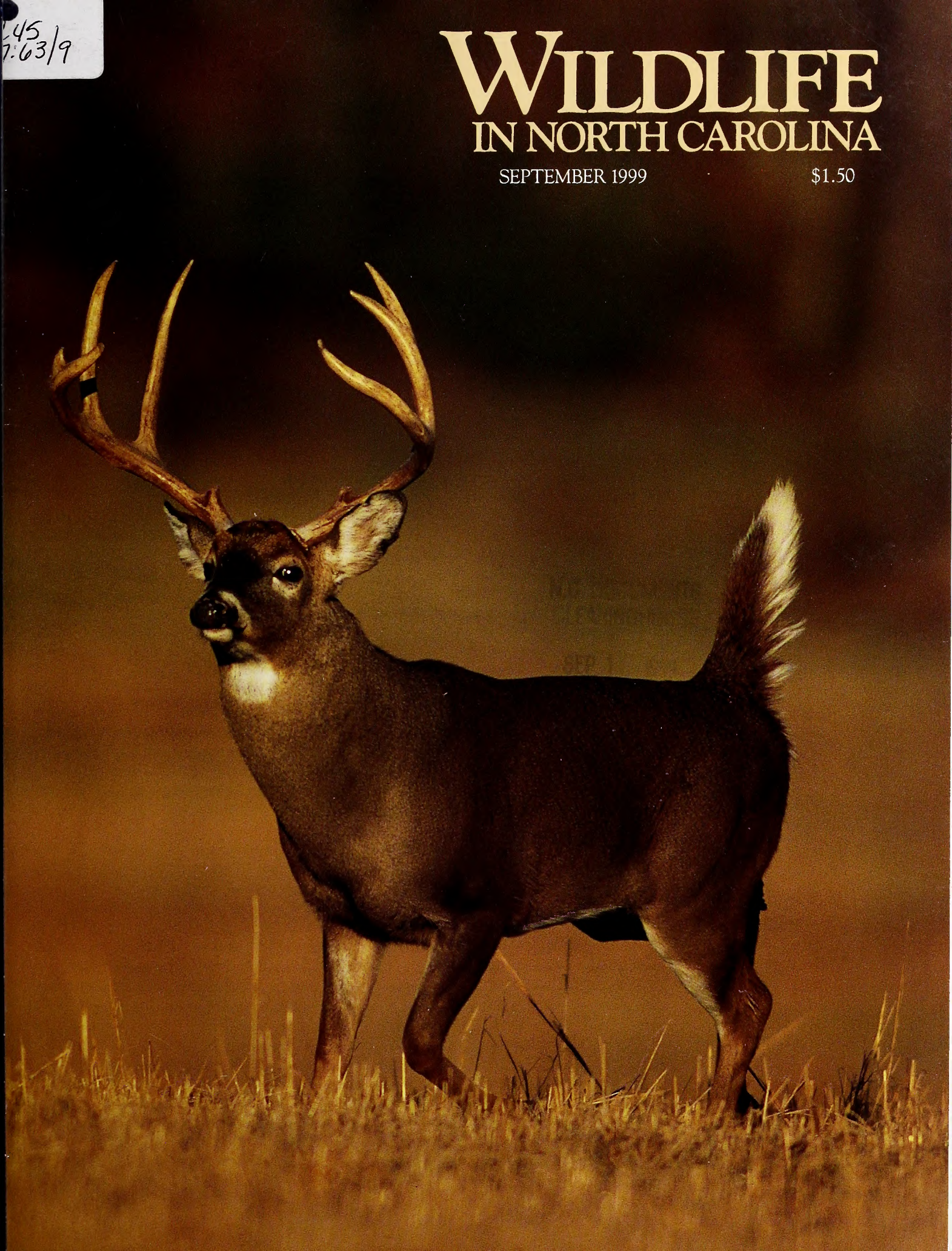
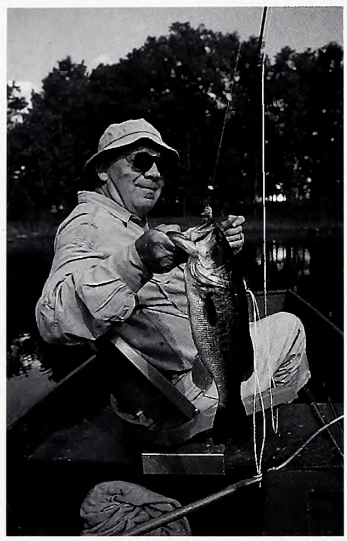
WILDLIFE IN NORTH CAROLINA

SEPTEMBER 1999 $1.50



Buzzards, Bass and Bull

by Jim Dean ©1999



JIM DEAN

Matt Hodgson

"Sure, there are trips when ideal weather, handsome surroundings and other serendipitous contributions mark a day as special, but it helps amazingly if the fish cooperate."

"Whew, that is intense," I said, as Matt Hodgson and I maneuvered my 12-foot johnboat into position to fish along the dam in one of the ponds at the farm this past summer. I'd caught the first whiff of rotting flesh while we were rigging up our fly rods at the truck, but now that we had crossed the pond we were directly downwind and obviously much nearer the source.

"That's an understatement," said Matt as he wiped his eyes in the late afternoon heat.

"We could load up and go to another pond," I ventured. It was a motion that would have surely passed unanimously had it not been for the fact that sizable largemouths had intercepted our deer-hair bugs on our first casts. The evening's fishing was off to an encouraging start; a most welcome change from two near fishless trips earlier that month. But then a truly nauseous wave arrived on the breeze just as we released those fish. The stench was so thick it would have held a fork.

As we gasped for breath, there was a sudden clatter in the woods just behind the dam as a dozen vultures, alarmed at our presence, abandoned their repast and flapped heavily into the limbs of a tall pine. So gorged were they with carrion that several broke the stout, living branches they had chosen and fell 30 feet to the ground like sacks of feed. Another sticky wave of rot—so vaporous it was nearly visible—rolled over us.

"It must be one of the bulls that got out of the pasture a few weeks ago," I said. "Curtis caught one, but not the other."

"You sure he caught one?" gagged Matt. "I would have no problem believing both bulls—indeed, his entire herd—had met with misfortune."

There was but one choice, and it didn't need further discussion. While satiated buzzards fell out of trees and the rest squabbled over their malodorous meal, we cast through the viscous atmosphere. It was clearly suppertime, above and below, a time ripe for scavengers of every ilk to seize the moment. We caught a dozen fat largemouths. That may well have been last season's most memorable day of bass bugging—bull and buzzards notwithstanding.

The truth is that fish simply don't go on wild feeding sprees all that often, and you can't waste an opportunity. Even if you fish a lot, you may not encounter such conditions more than a few times a year. Sure, there are trips when ideal weather, handsome surroundings and other serendipitous contributions mark a day as special, but it helps amazingly if the fish cooperate.

"You would quickly get bored with fishing if the fish practically leaped into the boat every time you went," a companion once told me. "It would be no challenge." This observation, by the way, comes from a companion who never fails to note that "It is good just getting out" after any trip when our execution has fallen short of our hopes. Alas, it has been "good just getting out" far too often to suit me.

Yet once in a rare while, fishermen are rewarded for their persistence even when the odds seem to be against it. It was 95-plus at 4 o'clock one afternoon later this past summer when Jack Avent and I launched the boat in a pond. Given the conditions, we had no unrealistic expectations.

Yet, two hours later we had a 5-gallon bucket full of big crappies and bluegills that we'd caught on ultra-light spinning rods and jigs. As the shadows stretched across the pond, we sat the bucket on the bank and rigged our fly rods. In the sultry stillness after sundown, bass sucked in our floating deer-hair bugs on nearly every cast—two bass went nearly 4 pounds—and we wound up catching at least 15. Did it bother us that our skills were not challenged? Not a bit. Every fisherman deserves a day like that occasionally. For one thing, it reminds us how unsatisfying, by comparison, it is to have poor luck and lie about it. Dangerous, too.

Some years ago, my son, Scott, and daughter, Susan, accompanied me on a trip out west to fish for wild browns and rainbows. We didn't have a guide the first afternoon we arrived, but we were eager to get started and spent a few hours fishing a short stretch of the upper Madison River. Later, back at camp, we ran into two other fishermen. "Any luck?" I asked.

"We smoked 'em big time," they said enthusiastically. "Must have caught two dozen nice rainbows and a few browns up to 19 inches. How did you do?"

I allowed that we had not done quite so well. I was content to leave it at that, but Susan wasn't.

"We smoked two little ones," she added cheerfully.

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Wildlife in North Carolina

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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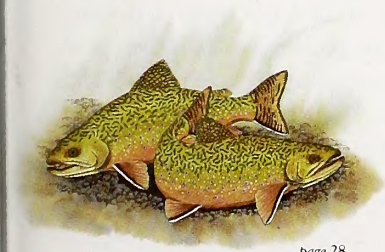

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Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 919-733-4376. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Those Confusing Color Phases

written by Jeff Beane ©1999
illustrated by David Williams

Color is important in nature. For many creatures, it figures heavily in camouflage, species recognition, sexual selection and defense. If you've ever wondered why some species come in different colors, you're not alone—biologists have long pondered such questions. Often the answers are apparent, but sometimes they are less clear.

With many organisms, the sexes are differently colored, and usually the reason is obvious. In species with visual courtship displays, including many birds and fishes, males are often brightly colored—or become so during breeding season—to entice females. But individuals within a species can vary in color for many other reasons, some of which we are only beginning to understand.

Fox squirrels in the Southeast come in several color phases, including black or partially black forms. There is evidence that this melanism evolved as camouflage against the blackened tree trunks of the fire-dependent longleaf pine forests. In other regions, fox squirrels live in climax forests and no black color phase occurs.

Some northern populations of gray squirrels are also melanistic, but for a different reason: Darker animals warm up faster and retain heat longer—useful features in a cool climate. In the South, melanistic gray squirrels are rare, having less need for heat retention, and, unlike the fox squirrel, inhabiting primarily hardwood forests where fires seldom blacken trees.

Another example of geographic color variation is the rat snake, one of our most familiar reptiles. In North Carolina, adult rat snakes from the Mountains and Piedmont are black, those from the southeastern Coastal Plain are greenish or yellowish with dark stripes, and those in between may be black, greenish or a grayish blend. The greenish, striped form may be better camouflaged, but black individuals absorb heat more quickly and are better adapted for cooler climates. All rat snakes hatch with a blotched pattern, losing it as they mature, probably because camouflage is more important to a vulnerable hatchling than to a 6-foot adult.

It is easy to conclude that snakes from cooler regions have an advantage in being darker, but another common species—the eastern hognose snake—has a black color phase which doesn't fit that explanation. Though all hatch with blotched patterns, adult hognose snakes from the same area—or even the same egg clutch—can grow up to be colorful and spotted, or jet black, or something in between. In fact, the black phase may be slightly more common in the warmer Coastal Plain, and the reason why is unknown.

Similarly, screech owls come in a red and a gray color phase—unrelated to sex, age or season—and again the reason is not clear. It has been suggested that the red phase is better adapted for colder temperatures—not because of the red coloration, but because of other traits or behaviors linked to that color phase. Studies on the subject have thus far proven inconclusive, however, and in North Carolina screech owls appear to be equally common in the warm Coastal Plain and cooler Mountains.

In some species, color phases are sex-linked. Male tiger swallowtail butterflies are nearly always yellow with black markings, but females exhibit a yellow and a black phase. The black females are thought (along with several other butterfly species) to be mimics of the bad-tasting pipe-vine swallowtail. They are probably better protected than the yellow forms, but the protection may come with a price, for males appear to prefer yellow females to dark ones.

Our own species exhibits considerable variation in skin, hair and eye color. Darker skin and iris pigments originated in tropical regions, providing protection from the sun's ultraviolet rays, whereas pale skin and blue eyes likely developed in the less sunny parts of Europe. Since we have only recently spread ourselves across the globe and developed technologies against varying climatic conditions, our color differences remain, even though they may no longer serve their original functions. One may delight in the fact that there are blondes, brunettes and redheads without troubling over why. The simplest explanation may be that nature likes to experiment. And who, after all, has more right to do so?

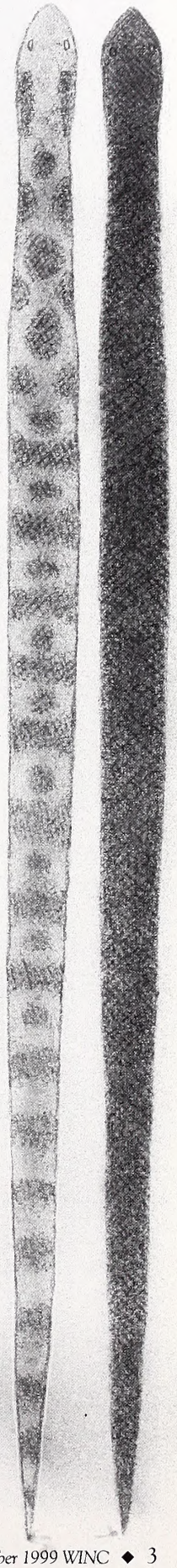
Jeff Beane is a curator of reptiles and amphibians at the N.C. State Museum of Natural Sciences in Raleigh.

Other Reading

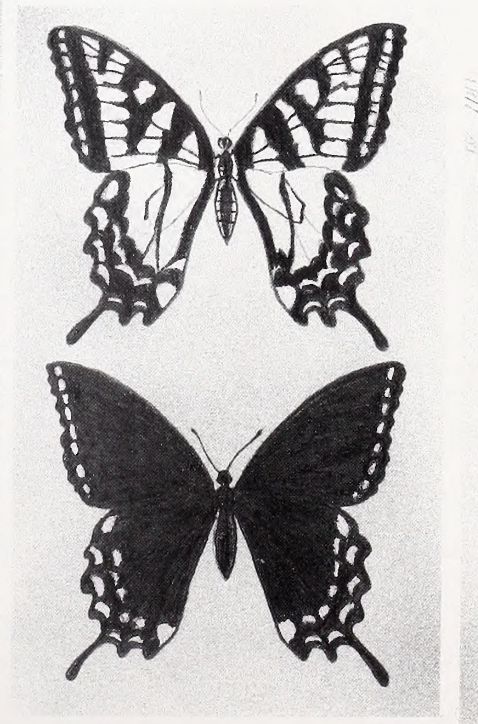
- "Wildfire and the Evolution of Dorsal Melanism in Fox Squirrels, *Sciurus niger*," by Richard A. Kiltie (*Journal of Mammalogy* 70 (4): 726-739,1989).
- Kettlewell, B., *The Evolution of Melanism* (Clarendon Press, Oxford, England, 1973).

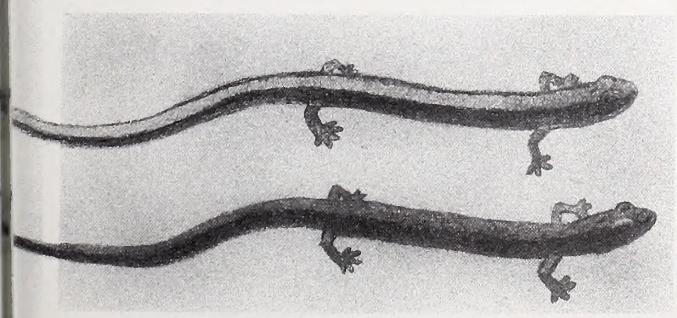
Fox squirrels may owe *their remarkable color variation to the constantly changing nature of their longleaf pine habitat. After forests burn, black squirrels may be better camouflaged against the charred tree trunks. During long breaks between fires, brown or gray individuals may have an advantage.*

All eastern hognose *snakes hatch with spotted patterns, but some individuals remain spotted and colorful while others turn black with age. The reason why remains one of nature's secrets.*



Female eastern tiger *swallowtail butterflies may be either yellow or black. Black males are very rare. Yellow females appear to be the preferred choice of males seeking mates, but dark ones may be better protected from predation.*





The redback salamander *has a "redback" (above) and a "leadback" (below) phase. In most areas, one or the other predominates, but in a few places, both occur with about equal frequency. The reason is unclear.*

DOVES *in the* PICKLE PATCH

written by Jim Dean ©1999

If you can't imagine doves eating cucumbers, squash, watermelons, sunflowers and other seed-producing foods, you're missing some good shooting, especially later in the season.

The dove season was set to open in a couple of weeks, and Mike Gaddis and I were planning our usual forays into rural counties east of Raleigh to check the corn crop on farms that we'd had permission to hunt in previous years. It didn't look promising. For the second summer in a row—this was in the mid-1980s—we had suffered a severe drought, and crops had dried up in the fields. Irrigation ponds had been pumped down to muddy puddles on tobacco farms, and most of the corn had gone unwatered in fields too big to irrigate.

I was not optimistic. Like most dove hunters, I had always hunted harvested corn. In most seasons, corn is a reliable source of dove food that makes for fast shooting, especially where it's been harvested mechanically, leaving lots of spilled kernels on the ground. Throughout North Carolina and much of the Southeast, a recently harvested field of corn has become the traditional centerpiece for early-season social hunts. These fields attract not only plenty of doves but also plenty of hunters, who gather to feast on barbecued pig, coleslaw, hush puppies and gallons of iced tea before heading out to shoot. If the corn crop had failed, what were the chances that we would find any huntable numbers of doves?

Our first scouting trip was disappointing. Corn that would normally have towered over our heads was stunted, the leaves tightly furled in the scorching heat.

"Not exactly as high as an elephant's eye," I remarked as we scanned yet another withered field.

"Yep, a cottontail on its hind legs would be darn near head high over anything growing here," said Mike, as we drove slowly down a two-lane blacktop bordering a field where

F. EUGENE HESTER

There's no disputing *a mourning dove's affinity for corn, but when the hunting gets tough, especially during the late season, doves can often be found in less traditional hunting spots such as cucumber and melon patches and even cotton fields.*

we'd found doves two years before. "I don't even see any ears of corn on those stalks; it's fodder at best, and not much of that. I'll bet a lot of it simply gets plowed under."

"I guess that means the doves will just pass through heading farther south," I ventured. "I hope they packed a lunch."

"I expect they will find food here, too," Mike said. "It just won't be corn."

Doves are pretty adaptable, and they like lots of other foods, he explained. We'd just have to find some of those other crops they like. In fact, the dry weather could even improve our prospects for good shooting over some of those crops. "I've never relied entirely on corn anyway," Mike said. "We're not licked yet."

Mike's assessment proved to be pretty close to the mark. We enjoyed some outstanding shooting that year, much of it while hunting crops that are overlooked by other dove hunters. I also learned some valuable lessons that have improved my dove hunting not only in dry years but also in years when rainfall is more normal and crops are hearty.

Mike believes that doves may actually prefer some of these alternative snacks even when there's plenty of recently harvested corn. Not only is it especially satisfying to sniff out a huntable batch of doves that nobody else knows about, but you also usually have the shooting to yourself. Some of these alternative foods mature later, and they may even afford shooting during the second half of the dove season. Cornfields also sometimes provide late-season shooting, but it's less reliable because corn is usually harvested fairly early, and good fields receive heavy hunting pressure. By mid-September, many areas are likely to be devoid of both corn and doves.

So what do opportunistic gourmet doves dine on when corn isn't available or they're not in the mood for an ear? Doves love grain crops, and among their favorites are sunflowers, millet and wheat. Doves especially love a sunflower seed—it may be their favorite food. That's no secret, of course, especially since sunflowers have been planted in greater numbers in recent years, not only as a cash crop but also purely to attract doves. The N.C. Wildlife Resources Commission plants some of its public dove areas in sunflowers, and many private shooting preserves have done the same. That year, we hunted several sunflower fields during the first few weeks of the season, and we also found plenty of doves in a couple of millet and wheat fields despite the dry conditions. But by mid-September, our favorite fields were no longer producing reliable shooting.

"Some grain crops, particularly sunflowers, tend to mature early even when rainfall is normal, so I'm not surprised that we're finding fewer doves in them now," Mike explained. "It often pays to switch tactics—and foods—as the season progresses."

JIM DEAN

JIM DEAN

JIM DEAN

Doves are adaptable *when it comes to finding food and rely on a variety of seeds, both large and small, to survive. Sunflowers (top) will nearly always attract doves, but seed-producing weeds such as foxtail (middle) and croton (bottom) will also draw doves when more traditional food sources are scarce.*

A couple of weeks later, Mike showed me one of his aces in the hole.

"So what's on the menu today?" I asked as we drove east.

"Pickles," he replied.

"You're kidding," I said. "Kosher dill or sweet?"

Mike just grinned, but the answer was evident when we arrived at an overgrown cucumber patch in Johnston County that had been abandoned when the cukes got too ripe for market. As is normally the case, there were still plenty of cucumbers in the field although many were now little more than dried white husks, splitting in the sun to spill their seeds. A dozen doves sat on a power line in the midday heat, while others flushed from the field as we walked to our shooting positions. It was a memorable hunt. Doves flew to us steadily, and by late afternoon, Mike's lab Squaw had retrieved our limits (actually, she had retrieved Mike's limit much earlier, but she waited patiently for me to discharge my customary two boxes of shells).

Not only do cucumbers almost invariably attract doves. So do squash, watermelons and similar vine crops. Sammy Giddens, who has hunted and trained dogs with Mike for many years, fondly recalls a particularly memorable late-season dove hunt that involved cucumbers and melons.

"We found this place where a small pond lay between fields of old cucumbers and watermelons," he said. "The fields had been disked, but that only seemed to make the supply of seeds more available to the doves. It was a perfect setup, and the shooting was great."

Another trick Mike taught me is to check out cotton fields. Of course, doves don't eat cotton, but they love the tiny seeds produced by a weed called croton that often grows in cotton fields. It's not by chance that croton is more commonly called dove weed. Learn to recognize it and you can have some outstanding hunts, especially if the farmer hasn't been too diligent in keeping weeds under control. Croton is also often found in other crops that have been left to grow up in a variety of weeds, but it's not the only weed seed that doves seem to like. Though less reliable, I've also had some good shooting where foxtail was abundant, although I suspect those weedy fields were producing a variety of seeds that doves like.

Chances are you're not likely to hunt one of the alternative dove foods that Mike and I once discovered quite by accident, but if nothing else, it illustrates how adaptable doves are when it comes to finding seeds. A dozen years ago, we were hunting a melon patch late in the season when we noticed that lots of doves were flying into a recently

F. EUGENE HESTER

***The hunter who** takes the time to scout and hunt alternative dove foods will often be rewarded with plenty of birds, especially during the late season. Weedy fields are just one of the many possible places to find good numbers of doves.*

disked field a few hundred yards away. There was nothing to indicate that a grain crop had been there, and we were puzzled until the farmer happened to come by to check on us.

"Do you own that field over there?" Mike asked him.

"No, it belongs to a neighbor," the farmer told us. "But he's temporarily out of the picture right now, and I'm keeping an eye on his land for him. He wouldn't mind if you hunted there."

"Really?" I asked. "So what was he growing?"

"Marijuana," he replied laconically. "Feds plowed it under a few days ago. Go hunt it."

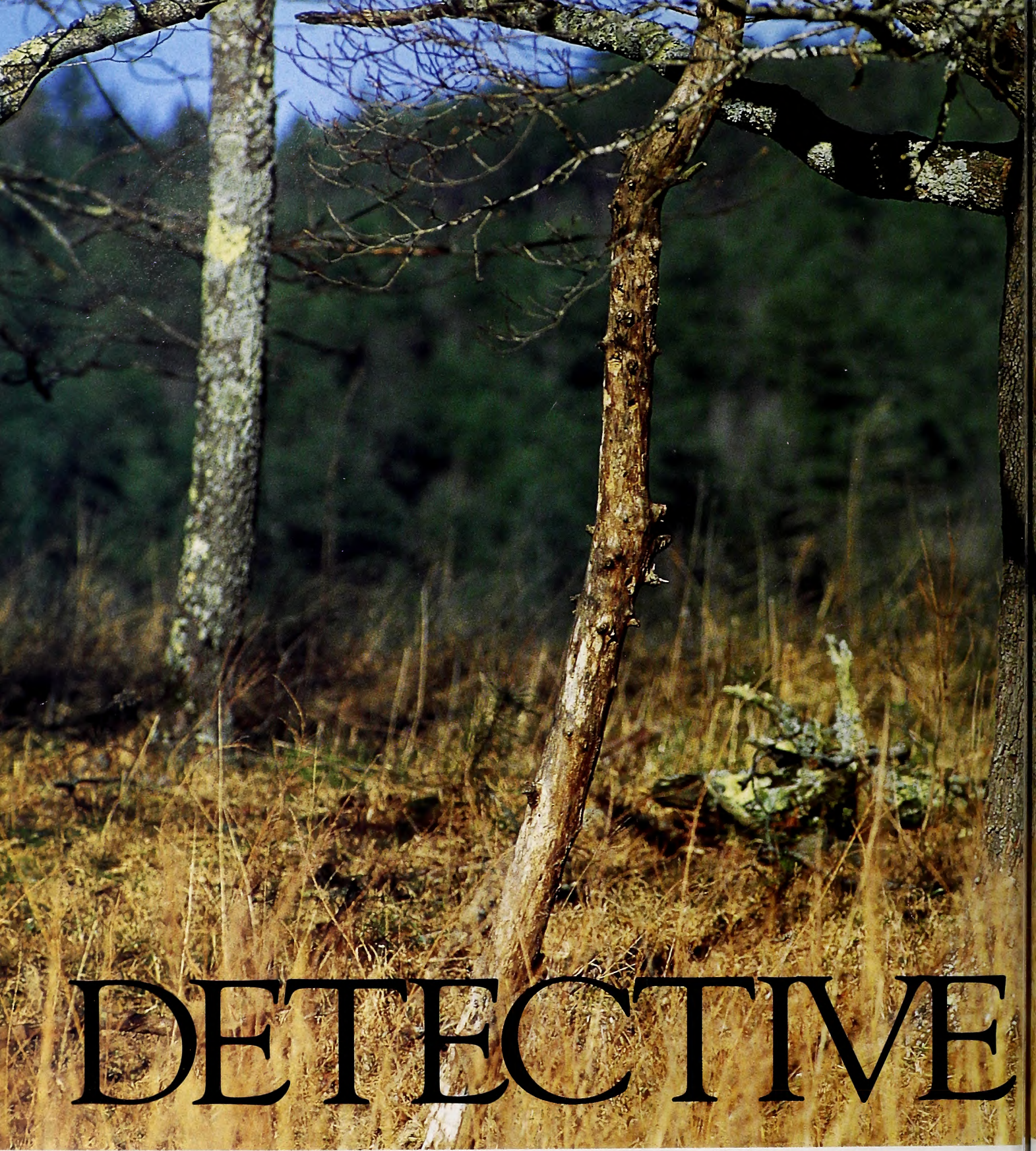
Was it just my imagination, or did those doves float into that field as though they really didn't care one way or the other whether we were shooting at them? One thing is for sure: they couldn't get enough of what they found there.

I'm not suggesting that you look for illegal crops, of course, but nowadays more than ever, it will pay to keep an eye out for good dove hunting in alternative crops. For one thing, it's not as easy to simply drive country roads and scout out fields, because once-reliable farming areas are undergoing increased development. It's also often harder to get permission to hunt. Some hunters have simply switched to private shooting preserves, where, for a fee, they can usually depend on a good hunt. Still, it's not impossible to scout out your own opportunities. Alternative crops may be harder to recognize and find (especially if they've been disked), and they're likely to be in smaller fields, but those small fields may also mean the doves are more concentrated.

Mike usually begins his scouting several weeks before opening day, driving back roads in rural farming areas. He has built up a network of friendships with farmers over the years—people who know and trust him to respect their property. He also carries binoculars and scans likely fields. When he finds a new area that looks promising, he introduces himself to the landowner and asks permission to hunt. If you're polite, promise to close gates, avoid shooting toward houses or barns and pick up spent shells, it's sometimes possible to get an invitation. It also helps to tell the landowner that you will always call in advance of any hunt, and assure him that you won't bring any hunters who aren't part of the invitation.

This dictates that you will usually be hunting alone or with only one or two other hunters, but that's not a problem. Experienced dove hunters can usually pick out the two or three best shooting stations, moving later in the afternoon if another station seems more promising. With fewer hunters to keep birds flying, it often pays to take the time to set up a crude blind, wear camouflage clothing and hang a few dove decoys, particularly late in the season, when doves are more wary.

And here's a tip from me—one that Mike doesn't need. Buy your dove shells early in the season, while supplies are high. Mike usually gets his limit with well under a box, but I could deplete the combined local stocks of Winchester and Federal shells single-handedly. ⊠



SCOTTY LOVETT

STORY

Deer hunters and detectives have a lot in common. They get their best results by looking for clues.

written by Gerald Almy ©1999

Shooting skills, woods savvy, a good hunting location, topnotch equipment—all of those things are important for ensuring a successful deer hunt. But none of them is as crucial as being able to find deer sign and knowing how to interpret it.

Whitetails usually leave an abundance of evidence going about the daily and seasonal activities of eating, traveling, bedding, rubbing antlers, making scrapes, fighting and breeding. Yet it's surprising how little most hunters know about where and how to find this sign, and what it means in the scheme of their hunting strategy.

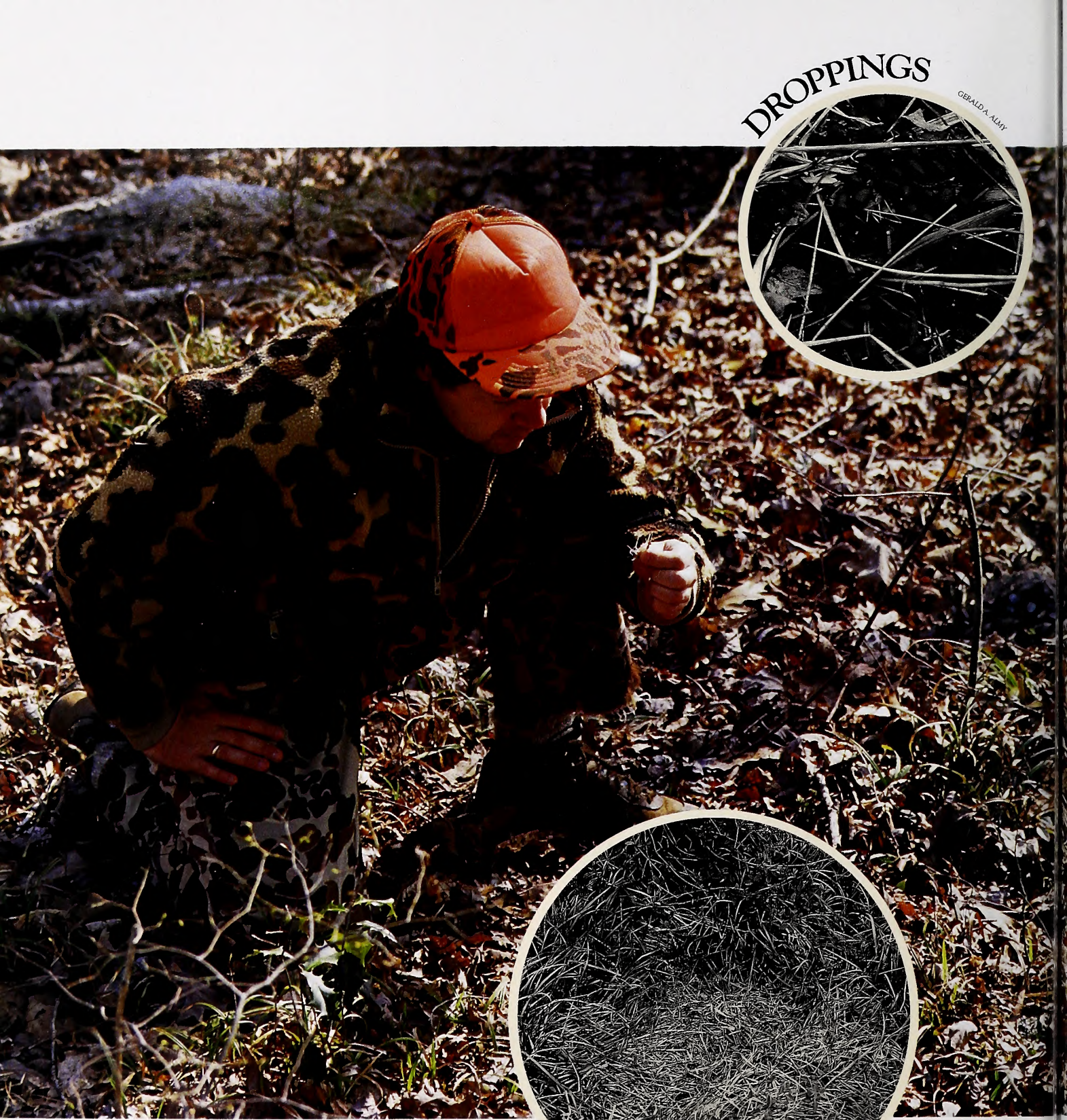
If you want to improve your luck on whitetails, it's important to learn what the major types of sign are, what they look like, where to find them, how to interpret them and what they mean in terms of formulating a hunting strategy. The first step is to buy a good compact notebook and pen, as well as the most detailed topographic map you can of the hunting area. You can sometimes obtain these maps locally, or they can be ordered from the N.C. Geological Survey, P.O. Box 27687, Raleigh, N.C. 27611; (919) 715-9718.

Use both the map and your notebook to mark important sign, as well as deer sightings, observations about their movement patterns and other things that might help you formulate a hunting strategy later. Note things such as prevailing winds, the presence of nearby deer stands on adjoining properties and types and thickness of vegetation. Also, you should take into account geographic features such as natural or manmade barriers that create travel funnels such as fences, gulleys or fallen trees. All of these things can help you plan your hunting strategy. But the most important notations to make in the notebook and map are about the sign you find.

This shouldn't be looked on as work or a chore. It is, in fact, an integral part of the hunt. All the preliminary scouting, field research and time that goes into unraveling the puzzle of whitetail behavior constitute the hunt's early stage. Searching for sign has another advantage, too: it brings your mind and senses back into tune with nature's relaxed pace. You will begin to really see, hear and smell again during these trips to locate sign. The renewed perceptiveness and awareness is vital for success once the season rolls in.

Here are the major types of sign to be on the lookout for, and what they mean.

***Want a shot at** this hoss? Then, you'd better do your homework. Veteran deer hunters know that the hunt actually begins with preseason scouting. By reading deer sign early, hunters can get an edge on an elusive trophy.*



A hunter examines *an area where deer recently moved through. By studying tracks as well as feeding and bedding areas, hunters can approximate where deer are heading and at what time of day.*

DROPPINGS

Small piles of oval brown pellets are definitely worth noting as you scout for deer before and during the hunting season. The amount of droppings will give you an approximation of how many deer are using the area, and the freshness will indicate whether deer are currently using that area. If the droppings are very fresh (shiny, soft and moist looking) you can ascertain about when the deer passed through the area.

MELISSA McGAW

TRACKS

A set of deer tracks in the ground can also be telling. If a track is dry and eroded, it was made a few days prior. However, if it is fresh and well defined, the track may be only hours old. Some hunters claim they can tell if a track is a buck's or a doe's by the dew claws, or whether the tracks are splayed or not. These methods are never totally reliable; however, if you find a very large hoofprint, it was probably made by a mature buck. Does often travel in groups, so if you find a single set of tracks, it's likely the marks are from a buck. Also, note the distance between the tracks when the animal is walking. A large buck will have a longer distance between steps than average deer.

Tracks may not be the most important sign, but at least they tell you that a deer used the area recently. And other than during the rut, when they travel more to breed, deer mainly move in the same areas between food, cover and water. By analyzing tracks, you may be able to determine whether it was a mature buck or a group of does, and what attracted them to that area.

TRAILS

Trails can be obvious after precipitation or faint if the weather's been dry or leaves have fallen. Routes indicate normal travel patterns where they are moving to destinations rather than browsing, ambling or socializing. These transitional zones are excellent bets for stands.

Using your topo map, try to interpret the lay of the land, location of the trail and when it is being used. Ask yourself: are these deer returning to bedding cover in early morning, using it to move down to feed just before dusk or heading for a mast-rich oak flat? By finding where several trails merge into a heavier, single path, you can increase your odds of seeing deer even further.

Another important tactic is deciding if a trail is being used during the day or strictly at night. During some of my early fumblings as a deer hunter, I remember wasting many mornings and evenings watching what, in retrospect, were clearly night-time travel corridors, because they were in such open areas and easily accessible.

The best trails will be those heading to thick bedding cover or dense, rugged escape areas. To find out when deer are using a particular trail, you can tie a thread across it and check back periodically to see when it is broken. Various devices are also sold that allow you to do this electronically. Some even allow you to rig a camera to a tree to get a snap shot of the animal! But no matter what your scouting and trail monitoring reveal, remember that whitetails are not totally predictable. They may use a certain trail one day, then use others for the next two days. Don't give up easily on a spot if it doesn't seem productive.

FEED AREAS

This is a broad category, but keep in mind that potential feed areas are not as important as those with fresh deer sign. This could mean an abandoned apple orchard with tracks, droppings and partially chewed fruit, or a crop field with fresh tracks. An area with oak trees that has leaves kicked up and scuffed, indicates that deer were there recently searching for acorns. A cornfield might have one corner with knocked-down stalks and gnawed ears.

Finding fresh feeding sign is important, but after you do so, you have to step back and look at the location, the amount of cover nearby and how much hunting pressure is prevalent in the area. That will tell you whether the spot might likely be good for a daytime stand. In general, feed areas are best during the bow season or in areas with light gun-hunting pressure. In other situations, deer, at least mature bucks, will tend to use open feed areas at night. The exception might be a food plot planted far back in the woods, or areas with abundant oaks and good cover.

The buck (below) *socializes with a doe prior to the fall mating period. Finding the location of a male deer before the fall rut is important because it means that area is likely his home turf.*

SCOTTY LOVETT

F. EUGENE HESTER

***The time a buck** is seen is also important to note. This information tells hunters when the buck is moving and where to. Was the deer seen standing at the edge of a soybean field at dusk? Or was he crossing the road toward hardwoods at dawn?*

If an area is most likely a night-feeding spot, it can still provide valuable sign. Simply find tracks and trails where animals have come into and exited the field and follow those back into the woods 30 to 40 yards during bow season and farther during gun season. That's where you'll most likely encounter bucks hanging back until darkness before entering the field or open feed area.

BEDS

Beds are areas where weeds or leaves have been mashed down by sleeping deer. A large bed is usually made by a mature buck. But once you find these, don't spend much time in the area. Instead, back off quietly until you find a place where the buck can be intercepted moving to or from his resting area. You don't want to drive the deer from these core areas.

RUBS

Bucks rub trees partly to help them remove velvet from their antlers, primarily in September. Serious rubbing generally begins in October and runs into November. Bucks rub then to take out aggression and tension from building testosterone levels, to leave their scent for both other bucks and does, and to visually mark their territory. These are one of the most important types of sign deer leave, particularly if you are hunting bucks. They are areas where the animals rub their antlers against saplings and small trees and scrape off the bark. The size of trees rubbed often, but not always, corresponds to the size of the buck. Small trees are typically rubbed by small to medium-sized bucks, but occasionally a large buck will rub them as well. Rubs made on large trees—meaning 3 to 8 inches in diameter—are almost always made by medium-to-large deer.

A series of rubs (called a rub line) is valuable because it tends to show the path a buck follows, at least on some days. It's also important to determine how fresh rubs are. Those that are dried up and turning dark are not much use. Fresh, light-colored rubs are good indicators of where a buck is traveling. I have taken many bucks by setting up on rub lines, and I've shot a few deer while they were rubbing the tree.

SCRAPES

These are cleared oval areas on the ground, anywhere from 2 to 3 feet in size, where a buck has pawed out the leaves and debris and urinated over its tarsal glands to attract does in heat. The scrape also marks the buck's breeding territory, though it is not uncommon for several bucks to visit a single scrape at different times.

A few scrapes are made in September, but the main activity takes place in October and November, with a lesser amount of scraping during December. The best scrapes are those with a small tree branch overhead that a buck has bent or broken and left scent on. Also, it's important that a scrape is fresh and damp with little or no debris or leaves in it. If you find a "hot" scrape with a broken branch over it, putting a stand downwind is definitely worthwhile.

GERALD A. ALMY

SCRAPES

GERALD A. ALMY

TRAILS

DEER-SIGHTING AREAS

Some may not call this sign, but if I'm out scouting or hunting and see a good buck, or if a reliable source sees one, I make a mental note of exactly where the animal was and record it later either in a notebook or on my topo map. It may be that the buck was simply roaming wide during the rut. But if the breeding period isn't in full swing, seeing a buck often means he's traveling within his home range.

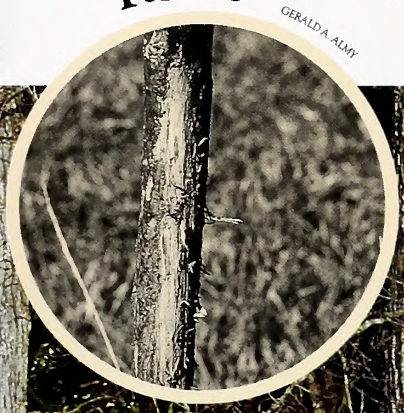
Visual sightings in a certain area may not be enough to warrant putting a stand up there, but by investigating

the area, you might find other sign such as rubs or a scrape. When you see an animal, also note the time of day and what direction it was traveling. This will help you determine where the animal was likely headed and when would be a good time to meet it there in the future.

If you see a good deer in the same area more than once, it's definitely a spot worth placing a stand near. It may take several days of watching, but chances are the buck will pass by there again, if you're patient. Many times the cycle will be three days. He might not show up for two days after you see him, but by the third day he'll pass through again.

Hunters shouldn't neglect the other aspects of deer hunting such as woodsmanship, shooting skills, exercising patience and having the right gear. But also don't overlook the importance of studying the clues left by deer. These signs will show you the way to more enjoyable and successful hunting. ⊠

RUBS



GERALD A. ALMY

MELISSA McGAW

***A father and daughter** hunting duo looks for trails, scrapes and rubs. Often, bucks will create a trail by rubbing a number of trees in a row. A bare spot on the ground (usually beneath an overhanging limb) means a buck has made a scrape by kicking leaves away. Bucks use these areas to rendezvous with does during the rut.*

Aldo Leopold's *A Sand County Almanac* is 50 years old this year, and if you haven't read this contemporary masterpiece, run—do not walk!—to your library and read it.

written by Lawrence S. Earley

KEN TAYLOR

"All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in the community, but his ethics prompt him also to co-operate....

"The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land." [Aldo Leopold, A Sand County Almanac]

Celebrating a

On the bookshelf of every sportsman and conservationist worthy of the name ought to be a slim book with a distinguished history. Rejected by several publishers before it was published in 1949, *A Sand County Almanac* has become one of the two or three greatest conservation classics ever published in America, arguably influencing more conservationists of the present day than any other book. Only Henry David Thoreau's *Walden* and Rachel Carson's *Silent Spring* offer serious competition.

Leopold's original contribution in this book was a concept he came to call the "land ethic." He summed up a lifetime of hunting and fishing, managing wildlife and observing the way people behaved toward their land by saying that land was abused because landowners thought of it primarily as a commodity "entailing privileges but not obligations."

"When we see land as a community to which we belong, we may begin to use it with love and respect," he wrote in *A Sand County Almanac*. "In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such."

What Leopold was suggesting was an idea so innovative—even revolutionary—that we still haven't come to grips with it today. He proposed a humbler and more profound understanding of land ownership—humbler, in seeing humans as only one of many organisms on the land; more profound, because the landowner had a responsibility for maintaining this community of soil, water, plants and wildlife.

Yet Leopold was hardly an ivory-tower intellectual, ranting about abstractions he knew nothing of. Leopold's formative years were spent as a hunter and fisherman, and his book is full of anecdotes of bygone days spent afield. Indeed, it was this experience that gave rise to many of his most deeply felt thoughts about wildlife. Hunting was only one way he connected to the land. After buying a piece of badly damaged prairie in Wisconsin in 1935 and nursing it back to health over the following decade, Leopold grew to understand first hand his role and responsibility in maintaining a healthy landscape.

In a speech to game managers in 1940, he said: "Our profession began with the job of producing something to shoot . . . . We find that we cannot produce much to shoot until the landowner changes his way of using land, and he in turn cannot change his ways until his teachers, bankers, customers, editors, governors and trespassers change their ideas about what land is for. To change ideas about what land is for is to change ideas about what anything is for. Thus we started to move a straw, and end up with the job of moving mountains."

It's a mountain that still exists, but it's moving—slowly, incrementally—like the Hatteras Lighthouse as it was moved on steel rails away from the threatening ocean. And among the forces behind this change in attitude toward the land are the ideas contained in *A Sand County Almanac*, truly a modern-day classic.

Aldo Leopold was one *of the first practitioners of wildlife management and wrote an influential textbook on the subject in 1933. He recognized that habitat was the key to healthy game populations, not the control of predators. His ideas profoundly influenced the thinking of game managers.*

Conservation Classic

ROBERT McCABE, UNIVERSITY OF WISCONSIN-MADISON ARCHIVES

Substitutes for a Land Ethic

from A Sand County Almanac, *by Aldo Leopold*

N.C. WILDLIFE RESOURCES COMMISSION

When the logic of history hungers for bread and we hand out a stone, we are at pains to explain how much the stone resembles bread. I now describe some of the stones which serve in lieu of a land ethic.

One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value. Wildflowers and songbirds are examples. Of the 22,000 higher plants and animals native to Wisconsin, it is doubtful whether more than 5 percent can be sold, fed, eaten, or otherwise put to economic use. Yet these creatures are members of the biotic community, and if (as I believe) its stability depends on its integrity, they are entitled to continuance.

When one of these non-economic categories is threatened, and if we happen to love it, we invent subterfuges to give it economic importance. At the beginning of the century, songbirds were supposed to be disappearing. Ornithologists jumped to the rescue with some distinctly shaky evidence to the effect that insects would eat us up if birds failed to control them. The evidence had to be economic in order to be valid.

It is painful to read these circumlocutions today. We have no land ethic yet, but we have at least drawn nearer the point of admitting that birds should continue as a matter of biotic right, regardless of the presence or absence of economic advantage to us.

A parallel situation exists in respect of predatory mammals, raptorial birds, and fish-eating birds. Time was when biologists somewhat overworked the evidence that these creatures preserve the health of game by killing weaklings, or that they control rodents for the farmer, or that they prey only on "worthless" species. Here again, the evidence had to be economic in order to be valid. It is only in recent years that we hear the more honest argument that predators are members of the community, and that no special interest has the right to exterminate them for the sake of a benefit, real or fancied, to itself. Unfortunately this enlightened view is still in the talk stage. In the field the extermination of predators goes merrily on: witness the impending erasure of the timber wolf by fiat of Congress, the Conservation Bureaus, and many state legislatures.

Some species of trees have been "read out of the party" by economics-minded foresters because they grow too slowly, or have too low a sale value to pay as timber crops: white cedar, tamarack, cypress, beech, and hemlock are examples. In Europe, where forestry is ecologically more advanced, the non-commercial tree species are recognized as members of the native

UNIVERSITY OF WISCONSIN-MADISON ARCHIVES

***As a young forester** with the U.S. Forest Service in 1911, Aldo Leopold often rode through the arid landscape of Arizona and New Mexico. It was here that he first discovered the ecological links between good habitat and wildlife populations.*

forest community, to be preserved as such, within reason. Moreover some (like beech) have been found to have a valuable function in building up soil fertility. The interdependence of the forest and its constituent tree species, ground flora, and fauna is taken for granted.

Lack of economic value is sometimes a character not only of species or groups, but of entire biotic communities: marshes, bogs, dunes, and "deserts" are examples. Our formula in such cases is to relegate their conservation to government refuges, monuments, or parks. The difficulty is that these communities are usually interspersed with more valuable private lands; the government cannot possibly own or control such scattered parcels. The net effect is that we have relegated some of them to ultimate extinction over large areas. If the private owner were ecologically minded, he would be proud to be the custodian of a reasonable proportion of such areas, which add diversity and beauty to his farm and to his community.

In some instances, the assumed lack of profit in these "waste" areas has proved to be wrong, but only after most of them had been done away with. The present scramble to reflood muskrat marshes is a case in point.

There is a clear tendency in American conservation to relegate to government all necessary jobs that private landowners fail to perform. Government ownership, operation, subsidy, or regulation is now widely prevalent in forestry, range management, soil and watershed management, park and wilderness conservation, fisheries management, and migratory bird management, with more to come. Most of this growth in governmental conservation is proper and logical, some of it is inevitable. That I imply no disapproval of it is implicit in the fact that I have spent most of my life working for it. Nevertheless the question arises: What is the ultimate magnitude of the enterprise. Will the tax base carry its eventual ramifications? At what point will governmental conservation, like the mastodon, become handicapped by its own dimensions? The answer, if there is any, seems to be in a land ethic, or some other force which assigns more obligation to the private landowners.

Industrial landowners and users, especially lumbermen and stockmen, are inclined to wail long and loudly about the extension of government ownership and regulation to land, but (with notable exceptions) they show little disposition to develop the only visible alternative: the voluntary practice of conservation on their own lands.

When the private landowner is asked to perform some unprofitable act for the good of the community, he today assents only with outstretched palm. If the act costs him cash this is fair and proper, but when it costs only forethought, open-mindedness, or time, the issue is at least debatable. The overwhelming growth of land-use subsidies in recent years must be ascribed, in large part, to the government's own agencies for conservation education: the land bureaus, the agricultural colleges, and the extension services. As far as I can detect, no ethical obligation toward land is taught in these institutions.

To sum up: a system of conservation based solely on economic self-interest is hopelessly lopsided. It tends to ignore, and thus eventually to eliminate, many elements in the land community that lack commercial value, but that are (as far as we know) essential to its healthy functioning. It assumes, falsely, I think, that the economic parts of the biotic clock will function without the uneconomic parts. It tends to relegate to government many functions eventually too large, too complex, or too widely dispersed to be performed by government.

An ethical obligation on the part of the private owner is the only visible remedy for these situations.

VIC VENTERS

From *A Sand County Almanac: and Sketches Here and There* by Aldo Leopold. Copyright 1949, 1977 by Oxford University Press Inc. Used by permission of Oxford University Press Inc.

Lessons from Leopold

What lessons does the work of Aldo Leopold still offer the citizens and sportsmen of North Carolina? Indeed, given the state's rate of growth and its rapid development of natural lands into subdivisions and shopping centers, is Leopold's "land ethic" even relevant any longer?

Those are some of the questions that Wildlife in North Carolina *asked Pete Bromley and Phil Doerr, both prominent wildlife biologists at N.C. State University. Bromley is professor of zoology and forestry and an extension leader in the Zoology Department who has been studying the effects of farm practices on wildlife for many years. Doerr, also a professor of zoology and forestry, has participated in one of the longest running studies ever mounted of the longleaf pine ecosystem and the red-cockaded woodpecker. In their teaching and work, both have demonstrated enormous respect for the words and thoughts of Leopold.*

KEN TAYLOR

BROMLEY—What you're asking is, is the land ethic living in the citizenry of North Carolina? Who in North Carolina takes actions that are contrary to their direct economic well being for the benefit of the ecosystem?

KEN TAYLOR

DOERR—Another way of saying it is, do their actions run contrary to their best economic interests? I think there are people who do this.

WINC—Who?

DOERR—Russ Oates, for one. He's a native of Rocky Mount. He's worked for a number of years with the U.S. Fish and Wildlife Service. He's bought 188 acres in the mountains and he's pursuing a wholistic, forest stewardship approach to managing his land. It exemplifies Leopold's notion that a man's treatment of the land is essentially his signature. Russ believes that. He wants to manage for the biodiversity on his land.

BROMLEY—Terry Sharpe is doing the same thing. He's the small game biologist with the N.C. Wildlife Resources Commission. He's got some land in Rockingham County. He's doing controlled burning on his land, looking for the orchids that come up after the burning and things like that. He's trying to act in concert with all the forces of nature on his land. But the thing is, he wants to do all these things and still make money on his land. He's growing a crop of trees. But he feels that there's more to his land than the money-making trees. The orchids are important and the chinquapins and he's willing to make compromises in order to care for them.

"I HAVE READ MANY DEFINITIONS OF WHAT IS A CONSERVATIONIST, AND WRITTEN NOT A FEW MYSELF, BUT I SUSPECT THAT THE BEST ONE IS WRITTEN NOT WITH A PEN, BUT WITH AN AXE. IT IS A MATTER OF WHAT A MAN THINKS ABOUT WHILE CHOPPING, OR WHILE DECIDING WHAT TO CHOP. AT EACH STROKE HE IS WRITING HIS SIGNATURE ON THE FACE OF HIS LAND."["AXE-IN-HAND"]

DOERR—Which is what Russ is doing. He wants to reintroduce things that are missing but were historically there.

BROMLEY—You asked what were Leopold's lessons for us. One of Leopold's greatest legacies was the way he expressed himself in metaphors, in comparisons. For example, he compared the wildlife biologist to a country doctor. The country doctor treated the whole person—mind, body, passion, emotion. The country doctor was wisdom and action in one package, not fractured by a million specializations.

DOERR—Much of his message is that you have to look at the whole landscape and the way you fit into it if you're going to understand whether or not the landscape is operating in a normal, healthy way. You have to look at the large picture—everything from the soil to the farmer and the tractor. You had to understand it all.

BROMLEY—You know, there are probably no organizations in North Carolina closer to what Aldo Leopold stood for than The Nature Conservancy and the regional land trusts throughout the state. These groups are showing citizens who have that land ethic that they can donate a conservation easement to protect their land—a working farm, a producing forest, scenic values—and yet still protect the biota. You ask, does the Leopold ethic still exist? I think it exists in the hearts of anyone who donates an easement at something less than fair market value.

DOERR—Those permanent easements are really wonderful (see "A Green Choice at Tax Time," February 1999).

BROMLEY—And some of these are sponsored by the Farm Bill programs (see "Big Hopes for Small Game," May 1999). Recently, an enhanced version of the Conservation Reserve Program (CRP) called CREP was passed to protect water quality following the uproar over *Pfiesteria*. Now we have $275 million slated for expenditure in North Carolina.

WINC—But isn't Leopold skeptical of government money. He's saying, "Yeah, $275 million can change a lot of minds. But take it away and now we see who are the true conservationists." Isn't that supposed to be where the land ethic comes in?

BROMLEY—But he also says, you can't expect the working farmer to create huntable game populations for the public at large without some compensation. That's the point of view that I'm working on. The public who hunts will compensate the farmer.

DOERR—Another lesson . . . . Leopold wrote in 1919 about the need for public game lands—"Democracy and Sport." At that point he was writing about where the average man would be able to hunt as lands came to be harder to find and lands got tied up in big properties. And even with all the game lands, people are still asking, where do I hunt. And that's something to remember—Leopold was a "participating predator." He hunted. There's a difference between a wildlife conservationist and a "preservationist." There's a philosophy in the word "conservationist" that implies participation in the life forces.

BROMLEY—I don't consider it unthoughtful that I participate in nature. I have participated in the planting of many acres of wildlife plantings, and I've shot my share of turkeys, too.

DOERR—One of the things that I try to open

KEN TAYLOR

my students' eyes to is that it's okay to have a passion about the outdoors. Leopold emphasized, make sure you get out there and enjoy it, whichever your outdoor passion. You've got to have a passion and a feel for the land. That's why it comes back to the land ethic, because it's your connection to the land that you have to maintain. He worries about the fact that people forget. He says two of the dangers of civilization are that people forget where their heat and food come from.

"THERE ARE TWO SPIRITUAL DANGERS IN NOT OWNING A FARM. ONE IS THE DANGER OF SUPPOSING THAT BREAKFAST COMES FROM THE GROCERY, AND THE OTHER THAT HEAT COMES FROM THE FURNACE." ["GOOD OAK"]

BROMLEY—I'm frankly worried about people who are totally urban.

DOERR—The thing I'm worried about is getting our students out there. How is passion created? A lot of youngsters develop an interest by watching Audubon specials and the Discovery Channel, but I'm not convinced that students can develop a passion for the land and natural systems without being out there. There's no substitute to seeing what critters do.

BROMLEY—You don't have to chase turkeys across the top of mountains like I've done for the past 30 years. You ought to be out in the marshes, though. You ought to be in a cypress swamp listening to the barred owl hooting.

DOERR—Those are the kinds of things that sustain you.

WINC—Let's wrap this up. We started out wondering what Leopold still offered to the people of North Carolina, and even whether his ideas were relevant to this growing state at all. And I guess we have decided that he offers a lot.

BROMLEY—That's right. There are a lot of people who feel that when they leave this earth, they want their signature to be on the land, and they don't want it to be a subdivision, or a town house complex or a golf course.

DOERR—And it may be that those people are not a majority, but still there are a significant number of people who have concerns.

BROMLEY—You know, it's the opinion leaders, people like Leopold, who have established the ethical strength behind the federal and state legislation that is enabling us to do the right things. That's where Leopold came in, Leopold and his contemporaries and colleagues. They are the ones who say for everyone, in words that are memorable and in metaphors that you don't forget, all the things that help us justify and communicate our passions today. ⊠

ROBERT McCABE, UNIVERSITY OF WISCONSIN-MADISON ARCHIVES

By and About Aldo Leopold

- *A Sand County Almanac*, Aldo Leopold (Oxford University Press, 1966; Ballantine Books, 1966).
- *Aldo Leopold: His Life and Work*, Curt Meine ((University of Wisconsion Press, 1988).
- *Aldo Leopold, A Fierce Green Fire*, Marybeth Lorbiecki (Falcon Press, 1996).

***In 1935, Leopold** bought a piece of damaged prairie land and began to restore it. His experience helped him understand that landowners have a special responsibility to manage their land ethically.*

NORTH CAROLINA
Hunting Seasons 1999–2000

Species	Hunting Season	Daily Limit	Possession	Season
CROW	Thurs., Fri., Sat. of each week from June 1 to Feb. 27 plus Labor Day and Christmas Day (Seasons shown are valid through June 30, 2000.)	No restriction		
DOVE	Sept. 4 – Oct. 9 (12 noon through sunset from Sept. 4 through Sept. 10; thereafter, shooting hours are one-half hour before sunrise to sunset.) Nov. 22 – Nov. 27 Dec. 20 – Jan. 15 (Shooting hours are from one-half hour before sunrise until sunset during Nov. 22–27 & Dec. 20–Jan. 15 seasons.)	12	24	None
RAILS, MOORHENS & GALLINULES				
Moorhens and Gallinules	Sept. 4 – Nov. 12	15	30	None
Clapper Rail, King Rail	Sept. 4 – Nov. 12	15	30	None
Sora Rail, Virginia Rail	Sept. 4 – Nov. 12	25	25	None
CANADA GEESE	Sept. 7 – Sept. 30 (Except N.E. counties)[1] Sept. 1 – Sept. 20 (N.E. counties)[1]	5	10	None
MIGRATORY WATERFOWL	Federal regulations may be obtained by contacting a license agent or by calling toll free 1-800-675-0263 after Labor Day.			
EXPERIMENTAL TEAL SEASON	Sept. 9 – 18 (east of U.S. 17 only)	4	8	None
DEER		2	6[2]	6[2]
Bow and Arrow	Sept. 13 – Oct. 9 (Eastern)[3] Sept. 13 – Oct. 9 and Oct. 18 – Nov. 20 (Western)[3] Sept. 13 – Nov. 6 (Central)[3] Sept. 13 – Nov. 13 (Northwestern)			
Muzzleloading	Oct. 11 – Oct. 16 (Eastern)[3] Oct. 11 – Oct. 16 (Western) Nov. 8 – Nov. 13 (Central)[3] Nov. 15 – Nov. 20 (Northwestern)			
Gun	Oct. 18 – Jan. 1 (Eastern)[3] Nov. 22 – Dec. 11 (Western)[3] Nov. 22 – Dec. 11 (Northwestern)[3]			

WILDLIFE WATCH
REPORT
REWARD
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Gun: Either Sex and

	Nov. 22 – Dec. 11 (Northwestern)[3]			
Gun, Either Sex and Special, Either Sex	See *1999–2000 North Carolina Inland Fishing, Hunting and Trapping Regulations Digest*			
BLACK BEAR	See *Regulations Digest*	1	1	1
WILD BOAR	Oct. 18 – Nov. 20 and Dec. 13–Jan. 1	1	1	2
RED & GRAY SQUIRREL	Oct. 18 – Jan. 31	8[4]	16	75
FOX SQUIRREL	Oct. 18 – Dec. 31 (Only in 20 counties; season closed elsewhere; see *Regulations Digest*)	1[4]	2	10
COMMON SNIPE	Nov. 15 – Feb. 28	8	16	None
QUAIL	Nov. 20 – Feb. 29	8	16	None
RUFFED GROUSE	Oct. 18 – Feb. 29	3	6	30
RACCOON & OPOSSUM	Oct. 18 (sunrise) – Feb. 29	No restriction on opossum See *Regulations Digest* for bag limits on raccoon		
RABBIT Rabbit—Box Trapping	Nov. 20 – Feb. 29 Nov. 20 – Feb. 29	5	10	75
PHEASANT—Non-native Male Pheasant Only	Nov. 20 – Feb. 1	3	6	30
WOODCOCK	Dec. 17 – Jan. 15	3	6	None
BOBCAT	Oct. 18 – Feb. 29[5]	No restriction		
FOX	See *Regulations Digest*			
GROUNDHOG	No closed season or bag limits			
COYOTE	No closed season or bag limits			
NUTRIA	No closed season or bag limits (except Currituck County, see *Regulations Digest*)			
WILD TURKEY Bearded Turkey Only	April 8 – May 6[5]	1	2	2

[1] Counties in N.E. Season are: Bertie, Camden, Chowan, Currituck, Dare, Hyde, Pasquotank, Perquimans, Tyrrell and Washington.
[2] Two of which must be antlerless, see *Regulations Digest*.
[3] See *1999–2000 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest* for approximate boundaries of Eastern, Central, Northwestern and Western deer seasons. For a copy of the *Digest*, write: N.C. Wildlife Resources Commission, 1313 Mail Service Center, Raleigh, N.C. 27699-1313.
[4] Total limit of 8 squirrels per day of which one can be a fox squirrel.
[5] Season varies by county; see *1999–2000 Regulations Digest*.

ONE Tough SON OF A Flower PICKER

Two hundred years ago he traveled through the wilds of western North Carolina. Today you can follow in William Bartram's footsteps along the spanking new 81-mile trail named after him.

written by T. Edward Nickens ©1999

The clouds suddenly cleared from the dome of Wayah Bald, and for a few moments I saw the land as William Bartram viewed it two centuries past. To the south loped the long, stegosaurian ridges of North Carolina's Nantahala Mountains clear to Rabun Bald in Georgia. To the northwest, scudding clouds snagged in the forested brow of Nantahala Gorge. Beyond rose the hazy palisades of the Snowbird and Unicoi mountains. The young pioneering botanist from Philadelphia stood near this 5,342-foot mountain in May 1775, alone, far beyond the frontier, and sized up his situation.

Bartram was midway into an odyssey through the wild Southeast that would cover hundreds of miles, span four years, and eventually spawn a best-selling book destined to enthrall readers on two continents and

WILLIAM S. LEA

View from the Bartram Trail at Wayah Bald.

ONE Tough SON OF A Flower PICKER

HARRY ELLIS

HARRY ELLIS

inspire artists and naturalists to this day. But on Wayah Bald, fame and posterity were probably the things farthest from his mind. He was bent on reaching the Cherokee Overhill towns, rarely visited by white men, in what is now Tennessee. And that great, blue bulwark of mountains to the northwest must have seemed a forbidding sight.

Not that Bartram was inhibited by terrain unknown or vertical. I found this out while hiking the footpath that bears his name, the recently completed, 81-mile, paint-still-wet-on-the-final-signpost North Carolina Bartram Trail. The scramble up Wayah Bald is on a grade fit for a mountain goat, or at least a hiker with younger knees. In this 11-mile stretch the trail climbs 5,000 feet and descends another two grand.

The rest of the path is similarly rugged. Tracing Bartram's route—as closely as is practical—through western North Carolina, his namesake trail skips across rocky crags and claws out of deep gorges. Here a run over lofty heath balds cloaked in rhododendron, there a hopscotch across major rivers and lesser cascades, the trail takes off into the very soul of the Southern Appalachians.

***A fall hike along** the Bartram Trail uncovers many botanical treasures that William Bartram would have seen, including such common plants as goldenrod (above) and dolls' eyes (below). The trail passes over mountain balds, through heavy-blossomed rhododendron thickets and loam-rich, old-growth forests where ancient chestnut stumps abound.*

The day I reached Wayah's summit, the wind whipped at 35 miles an hour, so I huddled behind the wall of a stone fire tower to read a sheaf of damp and tattered papers, my copy of *Travels Through North & South Carolina, Georgia, East & West Florida*, Bartram's account of his amazing journey. Alternately a lyrical panegyric to primordial nature, a call for peaceful relations with Native Americans, and above all an extensive botanical catalog, the book became an international best seller that influenced the science, politics and art of the day. Samuel Coleridge modeled scenes in his poem "Kubla Khan" on Bartram's journal, and William Wordsworth's descriptions of strawberry fields and flame azaleas in the poem "Ruth" were lifted off of its pages. *Travels* continues to inspire. Inman, lead character in Charles Frazier's Civil War epic *Cold Mountain*, the 1997 National Book Award winner, is a Bartram devotee.

My photocopies from *Travels* rattled violently in the wind, but still I found the sought-after passage:

> *I began again to ascend the Jore [Nantahala] Mountains, which I at length accomplished, and rested on the most elevated peak; from whence I beheld with rapture and astonishment a sublimely awful scene of power and magnificence, a world of mountains piled upon mountains.*

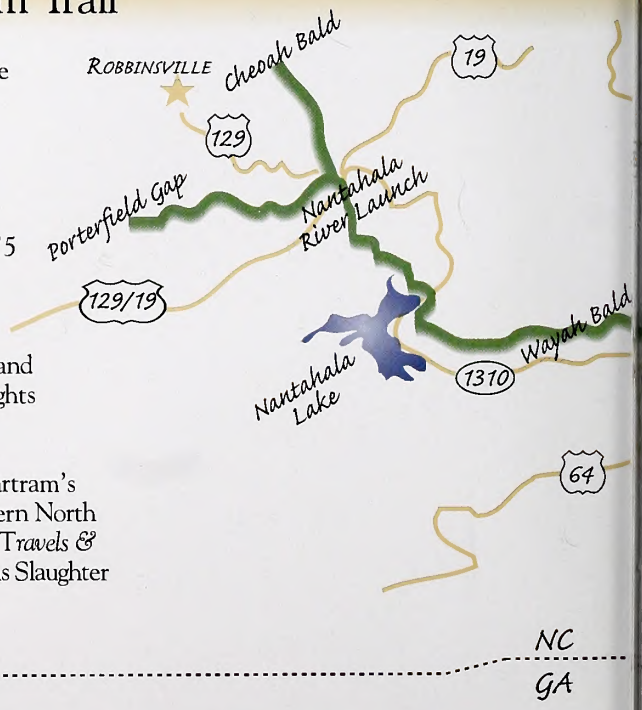
Hiking the Bartram Trail

To purchase maps to each of the trail's seven sections, send $14 to:

N.C. Bartram Society
P.O. Box 144
Scaly Mountain, N.C. 28775
(828) 526-4904

Each map shows the trail section marked on a topo map and has a good description of the sights on the other side.

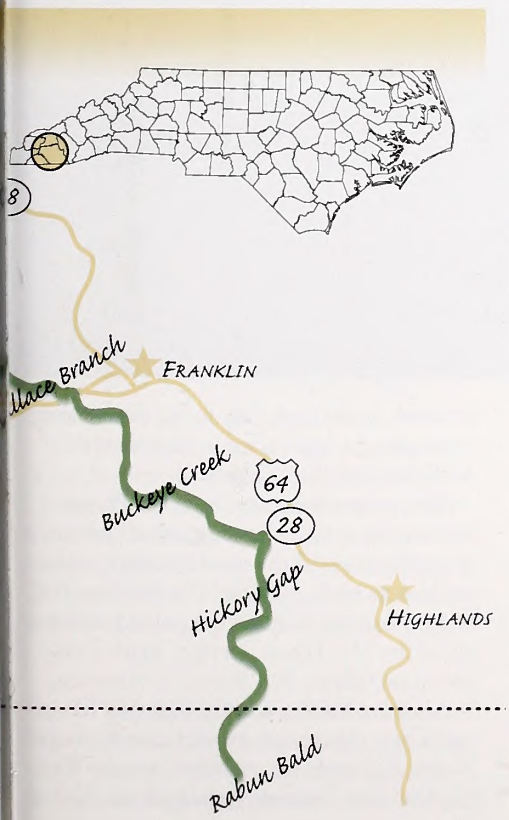
Chapters 2 and 3 of William Bartram's *Travels* cover his journey in western North Carolina. Most recent edition: *Travels & Other Writings*, edited by Thomas Slaughter ($37.50, Library of America).



Two hundred years later, of course, there is little unchanged about these mountains except the lay of the land itself. Gone are the Cherokee villages, the chestnut trees, the vast forests that never knew a saw. Though the woods today are no longer ancient, they still harbor trilliums and bright red partridge berries that draw the modern eye as readily as they did Bartram's. The unknown wilderness that attracted Bartram may be mapped, but who could thread the narrows of Ledbetter Creek or watch ravens play in the updrafts of Whiterock Mountain and not share Bartram's unbridled zeal for the unfolding land?

Maybe it's only wandering botanists and backpackers who learn the language of a landscape through the soles of their shoes—step by step, mile by mile, day by day. And thousand-foot climb by thousand-foot climb. That Billy Bartram, I muttered to myself on more than a few steep climbs, was one tough son-of-a-flowerpicker.

Could Bartram have imagined where his youthful vigor would lead? Son of the famed John Bartram, botanist to the English crown and founder of America's first botanical garden in Philadelphia, Pa., the youngster had already failed as an indigo planter and shopkeeper when physician and rare plant collector John Fothergill offered to underwrite a solo botanizing expedition. Bartram didn't hesitate. He set sail on March 20, 1773, to Charleston, S.C., then wound across the southeastern wilderness, up the Savannah River through Georgia, South Carolina, North Carolina, and then westward to the Mississippi River. His purpose, he wrote was "the discovery of rare and useful productions of nature, chiefly in the vegetable kingdom."



Mine was to see what remained of the wilds Bartram traveled by sampling this newly minted trail. I tackled all of the trail's seven distinct sections in spring through fall. Like Bartram, I traveled both alone and with companions. And although I never lucked into Cherokee chiefs or maidens picking fruit in the buff, as the young Quaker botanist did, I found myself similarly "seduced by [the] sublime enchanting scenes of primitive nature."

Such as when I crossed the stupendous Fishhawk Mountains in early June with botanist Dan Pittillo, a founding member of the North Carolina Bartram Trail Society. We climbed from the Georgia line to the crest of the Blue Ridge at Scaly Mountain, then hopped across half a dozen peaks slashed with cliffs of gneiss. We rounded switchbacks to find flame azaleas towering overhead—"the most gay and brilliant flowering shrub yet known," Bartram wrote of them—and hummingbirds flitting from flower to orange flower.

Hiking with Pittillo was a bit like taking a walk through the wilds with Bartram himself, although I doubt William B. wore a battered "Jack Daniels Field Tester" cap. Across Scaly Mountain, through a botanical paradise, Pittillo called out a litany of plants—"Solomon's seal," "sweetshrub," "prairie willow," "mountain camellia."

"Oh, my goodness, my goodness, what have we here?" he spouted at one point like a kid in a vernal candy store. "I do believe I've found something, yes, I do believe I have." Pittillo stood bolt upright, clutching a dripping mass of moss he pulled from a runnel. "*Fontanalia sphagnifolia*, I think," he said with a flourish, as if introducing me to some beautiful young niece. "Uncommon in this area."

Bartram was in search of the little-known, but Pittillo tells me he thinks there was a higher purpose in much of the 520-page *Travels*. "He was fueled to a great extent by his Quaker background," Pittillo said as we watched the sun paint the face of Whiterock Mountain with the lavender of a mountain laurel flower. "He felt that this was a beautiful place, God's blessing, and people needed to see it."

Pittillo's enthusiasm for flower and sprig was infectious. When we broke for lunch the next day on a rocky outcrop, he led me on a hands-and-knees exploration of Lilliputian forests of fungi, lichen and spikemosses, our noses but a few inches from a world I'd never considered, a living mosaic of greens and grays spackled with tiny, red fruiting bodies.

WILLIAM K. GEIGER

***The 81-mile** Bartram Trail can challenge even the most physically fit hikers. Before turning back to civilization, Bartram journeyed deep into the Nantahala Mountains mostly by himself. His book contains an excellent record of western North Carolina before the Cherokees were forced onto the "Trail of Tears."*

ONE Tough SON OF A Flower PICKER

T. EDWARD NICKENS

A lone hiker scans *the breathtaking panorama of the Blue Mountains. Scenic overlooks in high country give the hiker a chance to rest and think about the changes that have occurred since Bartram's day.*

"Botanists have extrapolated that it would take some lichens 600 years to cover a square meter of rock," Pittillo told me. "And here . . . ." He swept an arm out over a half-acre of lichen-covered gneiss.

We'll never know if Bartram wondered the same, for his actual route is etched in the vales below, where the Little Tennessee River winds through the lowlands. Leaning against his battered external frame pack, Pittillo warned me of "the temptation to think of William Bartram traveling through a wilderness of big trees and vast forest." Searching out plants useful to man, Bartram instead threaded the biologically diverse river valleys, marveling at their "fertile plains" and "sequestered, prolific fields" and following Indian trading paths, places now covered with asphalt and mountain towns. From Fishhawk Mountain I could see the dark cleft of the river below, and I thought that surely Bartram would have looked above the trees to these rocky cliffs beaming in the sun. But he never mentions them, intent on his northward quest into the Nantahala Mountains.

Much has changed since Bartram crossed the Nantahalas, hut the mountains haven't gotten any easier to climb—or to build a trail across. The North Carolina Bartram Trail was first sketched out in 1973 by a Bartram student named Walter G. McKelvey. Struck by Bartram's lyrical description of his homeland and drawing on training as a landscape architect, McKelvy spent four years negotiating the thickets of bureaucracy and rhododendron required to establish a new trail, only to die days before a meeting he had called to charter the N.C. Bartram Trail Society.

Since then the route has been altered slightly due to new thinking about Bartram's original route and the need to utilize public lands as much as possible. The Bartram Trail Society has also enlisted the pulaski-wielding aid of the U.S. Forest Service, Youth Conservation Corps, Boy Scouts of America, Nantahala Outdoor Center, Carolina Mountain Club, church groups and school groups. Nearly 200 fraternity men from nearby Western Carolina University grubbed out the last

few miles of trail to Cheoah Bald.

I followed the trail's cheery yellow blazes through increasingly rugged country. In the valleys below, feeding on biscuits, cheese, cow's tongue and wild edibles, Bartram probably had an easier time of it, and near present-day Franklin he and a temporary trailmate chanced upon a wondrous sight. "Young, innocent Cherokee virgins," Bartram wrote, gathering strawberries by a stream and "disclosing their beauties to the fluttering breeze."

Buck-naked women holding baskets of fruit—a vision worth two full pages in *Travels* with nary a plant described save the strawberries. "This sylvan scene of primitive innocence was enchanting," Bartram wrote in one of his few moments of understatement, "and perhaps too enticing for hearty young men long to continue idle spectators." Although he assures us that he intended no more than "innocent frolic," he nonetheless aroused the suspicions of a coterie of older chaperones—"envious matrons," Bartram laments, who chased him away.

Poor William B.— "left alone again in the dreary mountains," he laments as he began the difficult climb across the Nantahalas. As he crossed Nantahala Gorge, 8 miles long and 2,000 feet deep, he bumped into the Cherokee Chief Attakullakulla, or "Little Carpenter," who was traveling to Charleston to meet with the Superintendent of Indian Affairs. It was an encounter full of smiles and hand-shaking. I read the account by the light of my headlamp while camped atop Rattlesnake Knob on the lip of the gorge. Knowing what I did of the future of the tribe—the forced march of more than 13,000 Cherokee along the Trail of Tears to Oklahoma in 1838—lent an eerie undertone to Bartram's sanguine recollections.

Dropping off Rattlesnake Knob, I met Burt Kornegay, whom Bartram would have surely cottoned to. Kornegay had completed all the coursework for a Ph.D. in English when he shelved his dissertation to guide wilderness backpacking and canoeing trips. A self-described "Bartramaniac" and president of the N.C. Bartram Trail Society during much of the 1990s, Kornegay was a driving force in completing the trail.

We started our hike up and over the rim of the Nantahala Gorge to the trail's finale at Cheoah Bald, a 6.5-mile stretch that likely had seen the bootprints of only two or three groups of hikers before us. We scrambled up Ledbetter Creek, climbing jumbles of shattered stone and scurrying along an ancient pioneer trace lost to time and the rhododendrons until a trail scouting party rediscovered it. "We don't know the exact route Bartram took through these mountains," Kornegay explained. "He was at the Indian village of Cowe, just below Franklin, but exactly which valley or creek he followed over the mountains, we just can't be precise."

Whether I walked in Bartram's footsteps or only shadowed his journey seemed less important than being able to share his passion for the experience, the way each facet of nature, be it a blossom or a thunderstorm—"black clouds with august majesty and power, armed with terrors of thunder and fiery shafts of lightning"—brought about a near symphony of expression.

I thought of this as we made camp in a cove of hardwoods, Kornegay stringing up a large tarp for shelter. In the dark we talked about Bartram, about the hold he has on the Southeastern psyche 200 years after his footsteps faded from the mountains. "You can see it in his book. Everything about nature delighted him, and that was unusual for his time," Kornegay said. "But the world he described has disappeared. We can only find it in these old journals."

I spent a fitful night, awakened in turns by the deafening thrum of torrential rain, mists of splatter and the flash of lightning. Morning dawned with a gray yawn as we began to steep climb to Cheoah, another 1,000 feet above us, through a downpour destined to dump 6 inches of rain on the mountains and 2 inches into my boots.

Kornegay had previously described the view from Cheoah in majestic terms. "The grandstand of the Atlantic!" he claimed, with a panorama that takes in the entire route of the N.C. Bartram Trail. At the summit, however, a sodden gloom greeted us, the rain so heavy we had to shout to be heard. "Bummer," I muttered inside my rain hood.

I thought of Bartram's own darkened spirits that chased him to Cheoah's flanks. He had long left the settled valleys, and his previously joyous accounting began to take on somber tones. Trees and shrubs in the "dreary mountains" lagged behind the flush of spring growth in the warmer lowlands, and his travels involved "much toil and exercise." And Bartram, ever willing to give his "Indian brethren" the benefit of the doubt, began to worry about rumors of ill temper in the Overhill towns.

Somewhere near Cheetah Bald he halted. "I suddenly came to a resolution to defer these researches at this time," he wrote, and just like that, turned around and retraced his steps out of the Nantahalas and headed west to the Mississippi River. He arrived back in Philadelphia in January 1777, almost four years after leaving, and until his death nearly a half-century later was celebrated as the sage of American natural history. Enigmatically, his traveling days ended as soon as he arrived in the city of brotherly love. "He came down here for the Great American Adventure," said Kornegay, "and then never left home for another day in his life."

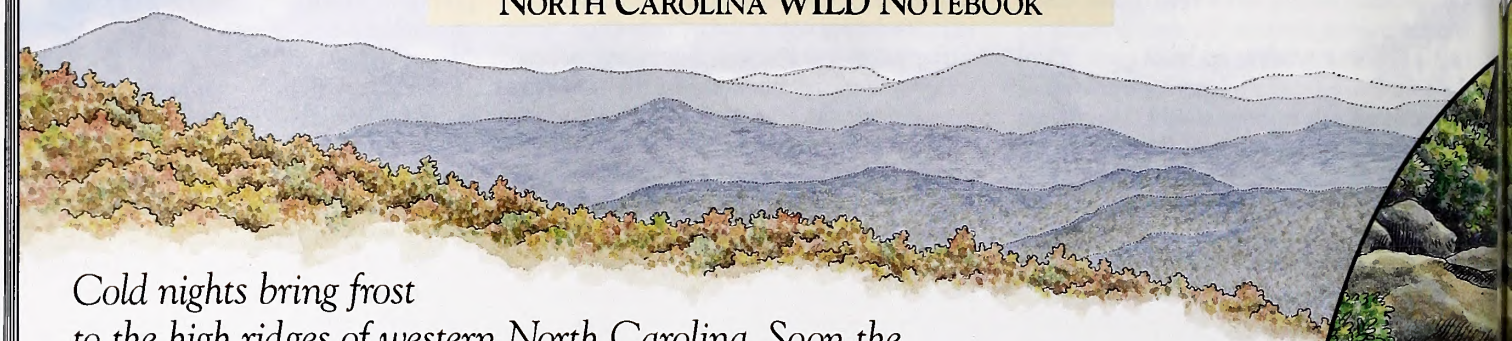
What he left behind, however, is of incomparable value: a catalog of more than 100 plants and 215 birds, some long since vanished from the Southeast; a travel epic that influenced art and science; an ethnographic treatise unmatched in its time; and now, a new route for hikers to discover the pleasures of nature.

Bartram's world has disappeared, but not his spirit of delight and adventure. It is written across the Nantahalas of North Carolina, 18 inches wide and 81 miles long. ⊠

"One Tough Son of a Flower Picker" was chosen as overall best magazine story for 1998 by the Outdoor Writers Association of America. It was first published in Backpacker *magazine.*

BURT KORNEGAY

***The freshly finished** sections of the Bartram Trail are attracting a growing number of hikers who appreciate the challenges and pleasures of the new trail.*



Cold nights bring frost to the high ridges of western North Carolina. Soon the mountains are ablaze in color. In the sparkling headwaters of a cold mountain stream beneath the colorful canopy, another age-old autumn event unfolds.

Speck-tacular Speckles

written by Terry Krautwurst
illustrated by Consie Powell

TIME TO SPAWN

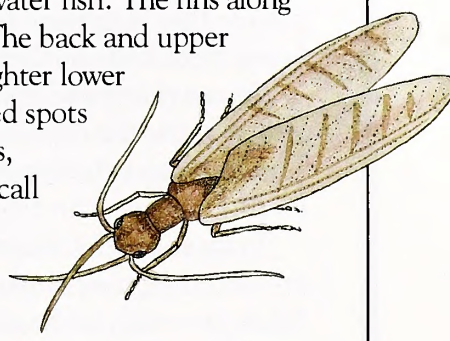
A female brook trout, fat with eggs, has found a clean gravel bed in a shallow section of cold, clear water. Moving her body from side to side, she sweeps away the pebbles beneath her, creating a bowl-shaped redd, or nest, about 2 inches deep.

Her mate darts to and fro, chasing away other fish that come too near. It is easy for intruders to see him. Wild brook trout are beautiful in any season, but at **spawning** time the male's colors are as brilliant as the autumn leaves above.

When the pair is ready to mate, the female settles into the redd and the male joins her. In the same instant that she lays her eggs—hundreds of them—he releases milt, or sperm. The female then covers the sticky, **fertilized** eggs with more gravel to protect them. Hungry and tired, the two brook trout move downstream, back to their usual **holding areas**, to seek food and to rest.

The eggs will remain in the redd, bathed in icy water, throughout the winter. But with the coming of warmer weather, usually in March, the fry will hatch, and a new generation of wild, spirited brook trout will swim this bubbling mountain stream.

JEWELS OF THE WATER



Brook trout are among the most beautiful of all freshwater fish. The fins along the belly are red with a black-and-white-striped edge. The back and upper sides are olive green, with dark, wavy markings. The lighter lower sides are sprinkled with yellow spots, mixed in with red spots surrounded by pale blue circles. Because of the spots, people in the Southern Appalachians traditionally call brook trout "speckled trout" or "speckles."

Brook trout have lived and reproduced in North Carolina's mountain waters for centuries. In fact, they are the only trout **native** to our state. When settlers first arrived in the mountains, the streams teemed with speckled trout. The fish thrived in the cold, pure creeks that spilled down the slopes and through the coves, fed by underground springs and abundant rainfall. The deep, still pools and swift **riffles** served up lots of **aquatic** and **terrestrial insects**—a brook trout's favorite foods. Streambed rocks, boulders and logs provided shelter. Dense forest foliage shaded the creeks, keeping the water cold year-round.

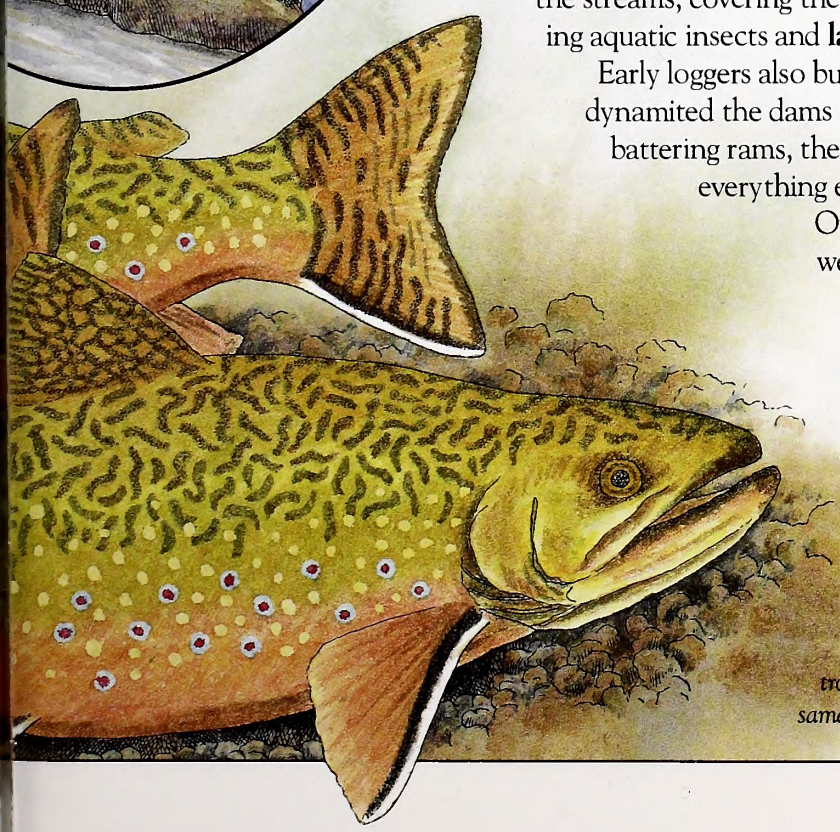
TURN-OF-THE-CENTURY TROUBLE

From the late 1800s through the early 1900s, logging companies cut nearly all the virgin timber from western North Carolina's steep mountains. The logging destroyed the shade that kept trout waters cool, and caused massive **erosion**. Without tree roots to hold it, thin mountain soil poured into the streams, covering the trout's spawning grounds with silt and smothering aquatic insects and **larvae**.

Early loggers also built dams on creeks to hold cut timber. Then they dynamited the dams to wash the logs downstream. Like hundreds of battering rams, the rushing logs took out huge boulders and almost everything else in their paths, demolishing precious habitat.

Overfishing also took its toll. Because the speckles were plentiful and easy to catch, a fisherman could harvest hundreds in a day. Settlers filled washtubs with an afternoon's catch.

Eventually, only the speckles that had lived in or moved to streams too high or remote for logging or intensive fishing remained.



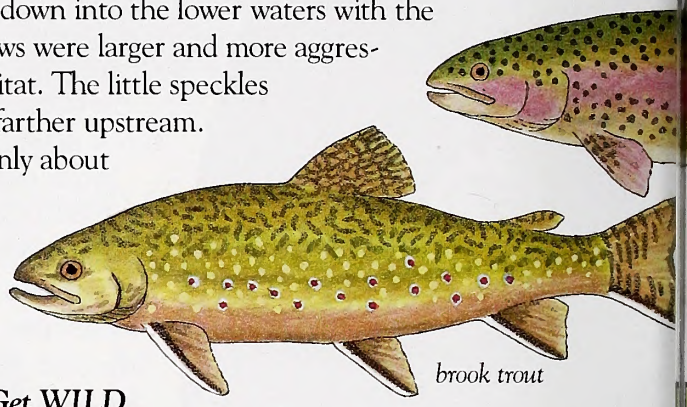
Technically, brook trout aren't trout at all! They're char—a group of fish that also includes lake trout and grayling. However, char and "true" trout such as rainbows and browns belong to the same biological family, Salmonidae.

MIXED BAG

To replace the lost brook trout, loggers and landowners stocked the empty water with fish from other places. They shipped in barrels full of brown trout from Europe, rainbow trout from the West and even brook trout from northern hatcheries.

The surviving wild speckles, they hoped, would move back down into the lower waters with the new fish. But the opposite happened. The browns and rainbows were larger and more aggressive than the native brook trout, and moved up into their habitat. The little speckles couldn't compete for food or shelter. They were pushed even farther upstream.

Today in North Carolina, wild native brook trout occupy only about one-fourth of their original range. Most live in small, isolated headwaters high in the mountains, in stream sections above waterfalls or other barriers too tall for other kinds of trout to leap.



brook trout

What Does It Mean?

spawning: the process of reproduction in fish
fertilized: an egg that has joined with a sperm
holding area: a place in a stream where a fish watches for drifting food
fry: baby fish
native: a plant or animal from a particular area, as opposed to one which was brought in from a different place
riffles: the shallow, swift-moving portions of a stream
aquatic insects: insects that live in water during at least one stage of their lives
terrestrial insects: insects that normally live on land—but may fall into water, becoming fish food
erosion: when soil is washed away by rain or flooding
larva (plural: larvae): the undeveloped, usually wormlike form of an insect just after it hatches from the egg
subspecies: a variation of a species (a species is a kind of plant or animal) found only in a certain geographic region

Read and Find Out

- *Freshwater Fish and Fishing* by Jim Arnosky, Four Winds Press, 1982.
- *Flies In The Water, Fish In The Air* by Jim Arnosky, Lothrop, Lee & Shepard Books, 1986.
- *Peterson First Guide to Fishes of North America* by Michael Filisky, Houghton Mifflin, 1998.
- *Freshwater Fishes of the Carolinas, Virginia, Maryland, & Delaware* by Fred C. Rohde, et al., University of North Carolina Press, 1994.

In *Wildlife in North Carolina*:

- "Wild Country, Wild Trout" by Joel Arrington, April 1983.
- "Life In A Trout Stream" by Lawrence S. Earley, March 1983.
- "Trout and Terrestrials" by Tom Earnhardt, June 1986.
- "Bright Leaves and Brookies" by Jeremy Grady, October 1995.

Editing and design by Consie Powell. Art puzzle by Anne Marshall Runyon.

Get WILD

Advanced WILD Workshop:

October 15-16 – *Predator/Prey (Raptors)*, Morrow Mountain State Park. Call Mel Porter, (704) 982-1523.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

The Beautiful Basics: teaches students about the five basic survival needs shared by people and all other animals.

Fashion a Fish: teaches students how body, shape and color influences a fish's adaptation to its environment.

Where Have All The Salmon Gone?: teaches students about the effects of human use and habitat changes on a fish population.

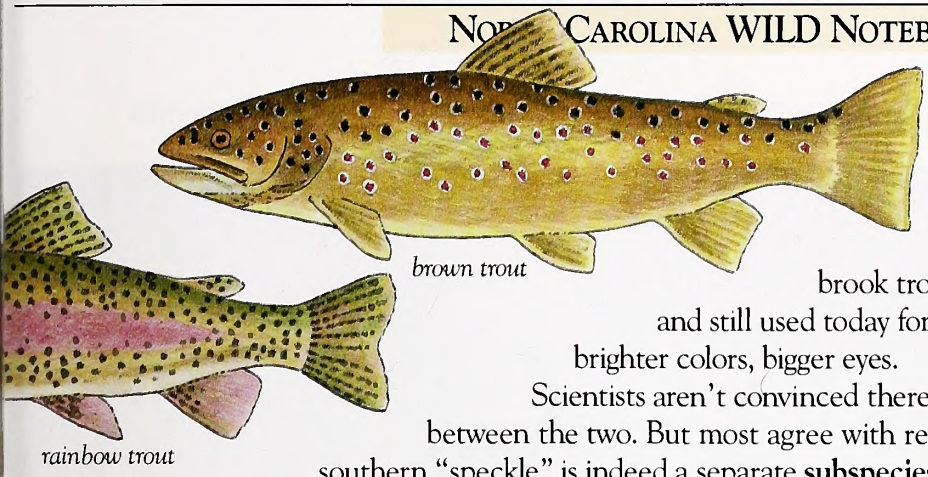
Get Outside

Hike a high mountain stream. Many trails in our mountain forests follow clear, bubbling streams studded with mossy boulders and fringed in laurel and rhododendrom. They're beautiful, special places to visit. No wonder brook trout live there!

Go fishing. Any time is a good time to go fishing, but fall may be the best of all. The days are sunny and cool, and most kinds of fish are actively feeding to fatten up for winter.

Do some fish-watching. The still pools below waterfalls can be good places to see trout and other fish feeding. Sit quietly above the water and watch. How many types of fish do you see? Do different kinds behave differently? Do they stay in certain parts of the stream? Are they facing upstream or down stream? Can you tell what they are eating? Bring binoculars for a better look.

Visit the Museum. Meet live brook trout as you discover the underwater world of fish. Learn how fishes breathe and swim, as well as what these scaly creatures eat. Sept. 7-10: Tuesday, Wednesday and Thursday, 10:30 a.m.; Friday, 12:00 noon. All programs are free. N.C. Museum of Natural Sciences. For more information, call (919) 733-7450.



brown trout

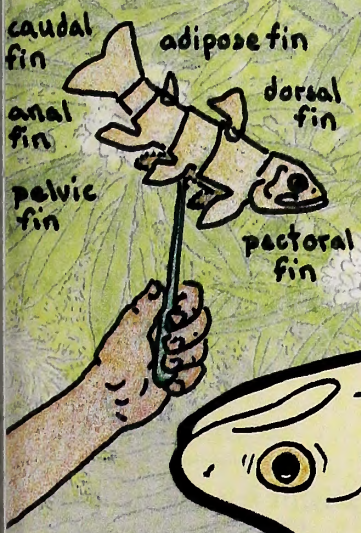
rainbow trout

A RARE BREED

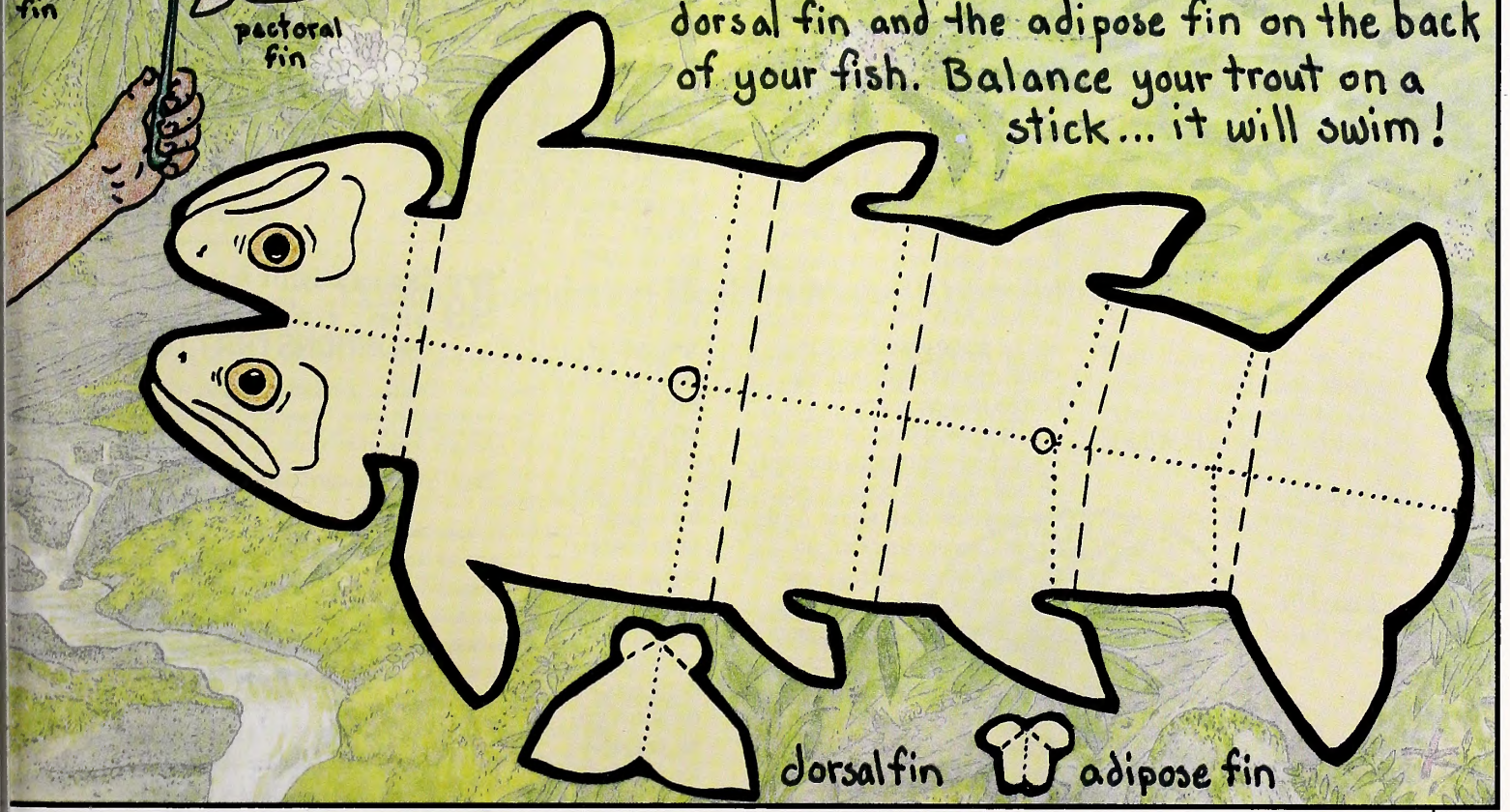
Old-timers have long claimed that "speckles"—the original wild trout in the southern Appalachians—are different from the northern-strain brook trout introduced to North Carolina streams and still used today for stocking. Real "specks," they say, have brighter colors, bigger eyes.

Scientists aren't convinced there's a reliable difference in appearance between the two. But most agree with recent genetic studies that suggest the southern "speckle" is indeed a separate **subspecies**. Biologists estimate that about 10 to 20 percent of North Carolina's remaining wild brook trout populations may be "the real thing." They are the last remnants of true Appalachian wilderness trout: pure, "speck-tacular" southern speckle.

Speckled Trout Sculpture



Photocopy at 140 percent. Cut fish and fins out along the ▬ lines. Fold ◁▷ along the ··· lines. Fold ▽ along the -- lines. (First make the long back fold, then make accordion side folds.) Glue the head, caudal fin and anal fin shut. Fold and glue the dorsal fin and the adipose fin on the back of your fish. Balance your trout on a stick... it will swim!



North Carolina Hunters No Longer Required to Tag Big Game Harvests

KEN TAYLOR

***The Wildlife Commission's** new reporting system requires hunters to use a report card (below, right) to document big game harvests, rather than the former tagging system.*

Edited by Chris Powell

Hunters will not be required to tag deer, wild turkey, bear and wild boar as a result of a recent rule change approved by the N.C. Wildlife Resources Commission for the 1999-2000 season.

Instead, all hunters will be required to note their harvests on a Big Game Harvest Report Card, which will be issued to each hunter upon purchase of a hunting license. Report cards will automatically be mailed to lifetime license holders. Also, free report cards will be made available to indiduals exempt from hunting license requirements.

The new rule requires hunters, before removing a downed animal, to cut a notch from the space on their report card (shown above) that indicates the animal's sex and species. Also, within 24 hours and before dressing an animal, hunters must obtain a Kill Report Authorization Number and write it on the space adjacent to the notched portion of the card. The authorization number can be obtained either by transporting the animal to a cooperator agent or by calling the toll-free telephone-reporting system (1-800-I-GOT-ONE). The authorization number must then be written in the space adjacent to the notched portion of the report card.

Animals may be field dressed prior to obtaining an authorization number; however, the speies and sex of the animal must be identifiable. The Big Game Report Card for the 1999-2000 season will have spaces to record six deer, two wild turkeys, two boar and one bear.

"The data we receive from hunters' report cards are crucial to ensuring that our various game species remain a viable resource for years to come," said David Cobb, chief of the Commission's Division of Wildlife Management . "Based on reported harvests, we can gauge the status of a species' population before setting bag limits for the following season."

It's also the law. Failure to properly register a big game animal can result in a $25 fine plus $85 court cost.

—Bodie McDowell

North Carolina Wildlife Resources Commission

99 Sales Outlet 000006007 00
01003 07/01/1999 14:34:56

-DEMONSTRATION-

Expiration Date 06/30/2000

Notch to validate Record authorization # in the space provided Hunters are no longer required to tag big game animals

CALL 1-800-I-GOT-ONE TO REPORT BIG GAME

=> Deer Auth. # _____
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=> Antlerless Deer Auth. # _____
=> Antlerless Deer Auth. # _____
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=> Wild Turkey Auth. # _____
=> Bear Auth. # _____
=> Wild Boar Auth. # _____
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Plans for Controversial Paper Plant on Roanoke River Suspended

The proposed construction of a controversial paper recycling plant on the Roanoke River near Weldon has been suspended, as a result of a pending business partnership.

Wisconsin Tissue, which is owned by Chesapeake Corp., based in Richmond, Va., had planned to build a $180 million mill and converting plant just below Weldon in Halifax County. However, a recent decision by Chesapeake Corp. to sell controlling interest of Wisconsin Tissue to Georgia-Pacific Corp. has put plans for the mill on hold.

Greg Guest, spokesperson for Georgia-Pacific Corp., said the Atlanta, Ga.-based company will wait until after the deal is final, in October, before assessing their needs for the mill. "The partnership needs to be officially formed," Guest said, "then we can make a decision about what kind of production capacity we will need down the road."

If built, the mill will be located just below Weldon in Halifax County, which is near the spawning grounds for striped bass and other fish species. The mill would produce paper napkins from recycled materials, and promises to bring 155 jobs to the economically depressed region.

KEN TAYLOR

***A proposed paper recycling plant** on the Roanoke River may not be built, after all. A business deal between two forest-products companies has put plans for the controversial plant on hold.*

But it's the plant's location on the banks of the Roanoke River and its planned discharge of up to 9 million gallons of wastewater per day that has environmentalists, biologists and fishermen concerned. Depending on what paper-bleaching process the proposed plant would use, dioxins, PCBs, heavy metals and other pollutants could be produced as byproducts.

Among the concerns of the N.C. Wildlife Resources Commission are the potential plant's impact on fish eggs and larvae as they drift past the plant's intake structures; the amount of oxygen-robbing material the plant will release into the river and the effects of pollutants on fish eggs and adult fish.

"Many public agencies and private groups have worked for more than two decades to recover the striped bass population in the Roanoke River," said Richard Hamilton, the Wildlife Commission's assistant director. "This is an important national fishery that thousands of anglers now enjoy every spring. This valuable resource warrants the highest level of protection."

In 1997, the Atlantic States Marine Fisheries Commission declared the Roanoke River/Albemarle Sound striped bass population to be fully recovered. The designation followed years of intensive fisheries management that included strict harvest limits, pollution controls and measures to regulate water flows on the river during the spawning season.

—Chris Powell

Habitat Foundation Reels in Major Contributor

Bass Pro Shops, in conjunction with the grand opening of its new North Carolina Outdoor World store, has selected the N.C. Wildlife Habitat Foundation as the beneficiary of its "Evening for Conservation" celebration. The Sept. 12 event will begin at 5:30 p.m. at the store's location near Concord (exit 49 off U.S. 85 at Speedway Boulevard).

"We are proud to be partners in conservation with the North Carolina Wildlife Habitat Foundation," said David McDonnell, general manager for the Concord Mills store. "We are impressed with their efforts to protect and manage wildlife habitat in North Carolina. As avid outdoorsmen and women, we are looking forward to a great evening and a successful partnership for years to come."

The occasion will feature a ribbon-cutting ceremony, a reception with store owner Johnny Morris and celebrity guests as well as refreshments, entertainment and a live auction.

Tickets will be $50 each and can be reserved in advance by calling (800) 347-4184.

The N.C. Wildlife Habitat Foundation is a nonprofit organization that raises money to promote habitat. The foundation often works with the N.C. Wildlife Resources Commission to help finance wildlife conservation projects.

"We are honored and very pleased to have Johnny Morris bring his Outdoor World store to North Carolina, and for his first order of business to be making a substantial contribution to North Carolina wildlife conservation," said Eddie Bridges, executive director of the N.C. Wildlife Habitat Foundation.

—Courtesy of the N.C. Wildlife Habitat Foundation

North Carolina Trout Regulations Updated

Editor's note: *The following regulations changes have occurred since the 1997 publication of the* Trout Fishing Maps *booklet. For a complete description of waters open to public fishing and regulations in effect, anglers should obtain a current copy of the* North Carolina Hunting and Fishing Regulations Digest. *The digest is available in most sporting goods stores, or by calling the N.C. Wildlife Resources Commission at (919) 733-3633, Ext. 281.*

Alleghany County
Helton Creek (Virginia state line to North Fork New River) is now classified as Delayed Harvest waters.

Waterfalls Creek (South Fork Little River) is no longer open to public fishing.

Ashe County
South Beaver Creek is no longer open to public fishing.

Avery County
Gragg Prong and its tributaries have been reclassified as Wild Trout waters.

Webb Prong and its tributaries have been reclassified as Wild Trout waters.

Burke County
Henry Fork: The upper end of the portion classified as Hatchery Supported waters now ends at the South Mountains State Park boundary.

Madison County
Big Laurel Creek (between the N.C. 208 bridge and the N.C. 25/70 bridge) is now open to public fishing, and is classified as Delayed Harvest waters.

Shelton Laurel Creek (from the N.C. 208 bridge at the Town of Belva to Big Laurel Creek) is now open to public fishing and is classified as Delayed Harvest trout waters.

Spillcorn Creek has been entirely reclassified as Wild Trout/Natural Bait waters.

Mitchell County
Cane Creek (between the N.C. 226 bridge and the N.C. 80 bridge) has been reclassified as Delayed Harvest waters.

Haywood County
West Fork Pigeon River: The upstream boundary designating the Hatchery Supported section of the river is now the triple arch bridge on N.C. 215. Also, the portion of the river upstream of the N.C. 215 bridge is now classified as Wild Trout waters.

Henderson County
Green River (from the I-26 bridge to the Polk County line) has been reclassified as Wild Trout waters.

Jackson County
Tuckasegee River (between the N.C. 116 bridge and Dillsboro Dam) has been reclassified as Delayed Harvest waters.

Polk County
Green River (from the Henderson County line to Fishtop Falls Access Area) is now classified as Wild Trout waters.

Rutherford County
(Rocky) Broad River: The lower boundary of the Hatchery Supported section is now the U.S. 74/64 bridge.

Surry County
Mitchell River (from .6 mile upstream of the end of N.C. 1333 to Kapps Mill Dam) is now open to public fishing and is classified as Delayed Harvest trout waters.

Transylvania County
Thompson River (from N.C. 1152 to and including Reid Branch—except where posted for trespassing—including portions of tributaries on game lands within this section) has been reclassified as Wild Trout waters. Also, the portion of Thompson River from Reid Branch to the South Carolina state line has been reclassified as Wild Trout/Natural Bait waters.

Watauga County
Boone Fork: The portion downstream of the Blue Ridge Parkway boundary is no longer open to public fishing.

Watauga River: The lower boundary of the portion classified as Wild Trout waters is now the N.C. 1580 bridge. The portion of the river from the N.C. 1580 bridge to Boone Fork is no longer open to public fishing. The upper boundary of the portion classified as Delayed Harvest waters is now the confluence with Boone Fork.

Wilkes County
Double Creek and Harris Creek are no longer open to public fishing.

—Courtesy of the Division of Inland Fisheries

On Patrol

Editor's note: *While most North Carolina sportsmen are law-abiding, a few are not. Listed below is a report of a wildlife violation that exemplifies the humorous, and at times bizarre, situations our North Carolina wildlife enforcement officers encounter while on patrol.*

Wildlife officers working in Pender and Lenoir counties recently made a number of dove cases that included: hunting in closed season, unplugged shotguns and taking migratory birds with a .22 rifle. Wildlife officers Andrew Waldrop and Jason A. McKinney came across a man who claimed to have shot a dove by accident while testing some turkey shells. Being the suspicious lot they are, the wildlife officers checked the man's truck where they found 80 more doves. Now that's some turkey load!

Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

Sept. 11, 12

The North Carolina Custom Knifemakers Guild will sponsor the Southeastern Custom Knife show at the Benton Convention Center Ballroom in Winston Salem. For more information, call Tommy McNabb at (336) 759-0640.

Sept. 18

The N.C. Wildlife Resources Commission will sponsor a youth Dove Hunt from 8 a.m to 6 p.m. at the Howell Woods Environmental Learning Center in Four Oaks. Youths, ages 12 to 15, must be Hunter Safety certified and be accompanied by an adult over age 21. For more information, call Cheryl West, Wildlife Commission special programs coordinator, at (919) 733-7123 Ext. 269.

Sept. 19, 20

The North Carolina Zoological Park, near Asheboro, will present its third annual "Herbs at the Zoo," from 9 a.m. to 5 p.m. at the zoo's North American region. The event will educate participants on the many uses of plants. For more information, call (800) 488-0444.

Sept. 23, 24

The Yadkin-PeeDee Lakes Project will sponsor a North Carolina "Central Park" Conference at Catawba College, in Salisbury, on sustainable development for the Yadkin-PeeDee River Basin. Space is limited. For more information, call Steve Spratt at (704) 422-3215.

Oct. 8-10

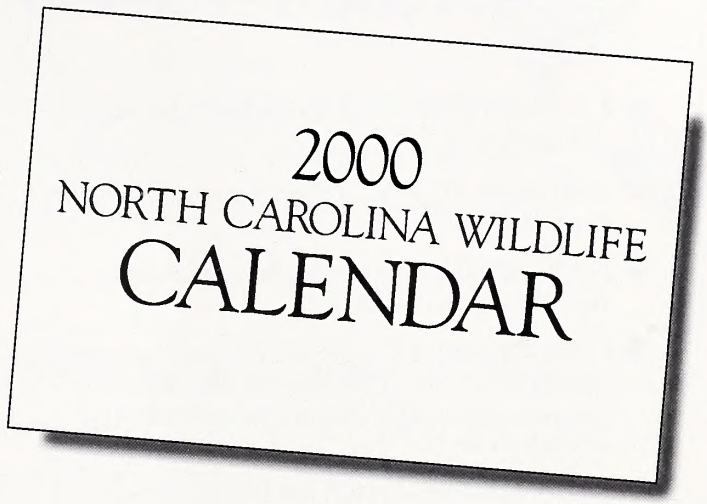
The Pine Knoll Shores aquarium, located in Atlantic Beach, will conduct an all-day program teaching participants how to surf fish. Anglers will learn about rods, reels, weights, line, tackle, knots, bait, fish identification, cast netting and much more. For more information, call (252) 247-4003.

St. John's wort

bee balm

witch hazel

The 2000 North Carolina Wildlife Calendar is Here!



With such fine artwork as Robert C. Flowers Jr.'s "The Gleaners" (featured on the inside back cover), the 2000 North Carolina Wildlife Calendar is sure to sell out. In addition to Flowers, the works of Robert B. Dance, Dempsey Essick, Duane Raver, David Williams, Brian Edwards, Joe Seme, Tim Larson, Keith Hendrickson and Curwood Harrison are featured.

Order yours today! Payment must accompany your order. Calendar orders may be charged to VISA or MasterCard, or enclose your check or money order (payable to NCWRC). Complete the form below and mail with payment to:

2000 Calendar, N.C. Wildlife Resources Commission
P.O. Box 29607, Raleigh, N.C. 27626-0607
(Office is located at 322 Chapanoke Road in Raleigh.)

A GREAT GIFT!

Please send me _____ Calendars at $6.00 each .....$_____

All N.C. residents add $.36 sales tax per calendar ..... _____

☐ Enclosed is my check for **total** payment of .....$_____

☐ Charge to MasterCard or VISA for the calendar(s) ordered above. My card number is _____ and the expiration date is _____/_____.

_____ (_____)_____
Card holder signature | Day Time Phone No.

If ordering 10 or more calendars, please provide your UPS deliverable address.

Name _____

Address _____

City/State/Zip_____

Phone (_____) _____

All orders must be prepaid. A $20 charge will be made on returned checks (N.C.G.S. 25-3-512). **For fund raising and bulk rate information (10 calendars or more), call 919-662-4377. Please allow 4 weeks for delivery.**

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through June 1999

Principal Balance
$27,987,638.37

Interest Earned
$28,479,434.67

Total Receipts
$56,467,073.04

Interest Used
$17,275,819.04

Fund Balance
$39,191,254.00

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.

Fall Reminders

by Rodney Foushee

Don't let the summer doldrums distract you from improving your property for wildlife. Here are a couple of reminders to keep you on track for fall.

Stocking Ponds: Fall is the right time to stock channel catfish and sunfish in new or reclaimed farm ponds. Both bluegills and shellcrackers make excellent choices for ponds and should be stocked at a ratio of 10 fingerlings per largemouth bass to reach a balanced population.

By postponing your bass stocking until early next summer, you can give the sunfish a chance to grow and begin spawning before the hungry bass arrive. For more information about pond management, contact the Wildlife Commission's Division of Inland Fisheries at (919) 733-3633.

Fall Flooding: Now is the time to begin flooding waterfowl impoundments on your land for early migrants including teal and pintails. Gradual flooding will provide food and cover to wildlife over a longer period than rapid flooding. Generally, gradual flooding with 20 percent of the impoundment covered with less than a foot of water is most beneficial for migrating waterfowl.

If you have several impoundments on your property, you can flood them in stages from September to December to provide food for latter migrants including black ducks, mallards, ringnecks and widgeon. Impoundments flooded in December will hold food and cover for waterfowl into early spring, sending the birds back to their northern breeding grounds in tiptop shape.

Eliminating Fescue: If you've considered reducing or eliminating fescue on your property to help wildlife, you're in luck. Fall is an excellent time to begin ridding areas of your property of tall fescue. The key to eradicating fescue is to attack the grass when it's actively growing. Cut your fescue back now through early October, and then allow it to regenerate before applying RoundUp or a similar herbicide. You can burn off the residue in late winter, and then apply another herbicide treatment in spring if necessary.

Once you've rid yourself of fescue, you'll want to plant native warm-season grasses such as bluestem and switchgrass on your land come spring. Contact your district wildlife biologist or call (919) 733-7291 for more information on converting to warm-season grasses.

N.C. WILD STORE

Don't Forget **Your** Back-to-School **Wildlife Power Pack!**

Fact: School starts soon. Another year of student projects on North Carolina's wildlife is creeping nearer. This year, order educational materials from the N.C. WILD Store to build a home wildlife library with a North Carolina focus. Here's what you can get:

1 *The big picture about North Carolina's habitats.* **North Carolina WILD Places: A Closer Look** has it all—it's a book that covers 13 of the state's major wildlife habitats and the ways fish and wildlife are adapted to them. The illustrations are wonderful! And three **posters** come with it.

2 *Information on individual species.* Remember how long it took your daughter last year to discover whether black bears sleep through North Carolina's mild winters? The **WILDlife Profiles & Binder** contains 120 fact sheets about everything from white-tailed deer and largemouth bass to spring peepers and monarch butterflies.

3 *Knowledge about how species interact.* The illustrated articles in the **Nature's Ways** books show the amazing ways that North Carolina's animals live together in their habitats.

4 *Posters for the young scholars'.* How about the **Reptiles of North Carolina** and the **Amphibians of North Carolina**?

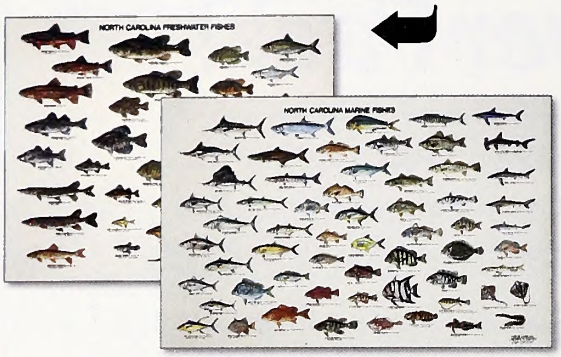
A **Wildlife Power Pack** is just what you need for the new school year. Look for the **apple symbol** inside!

More terrific items ☛

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

North Carolina's freshwater fish and marine fish are colorfully displayed on individual posters, and feature the art of Duane Raver. Reel yours in today!



Fishes of North Carolina

Set of 2. Freshwater fish poster shows 36 state species (size 28" x 22½"). Marine fish poster shows 60 species (size 35" x 22½") $10.

ITEM CODE **P9**

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50.

ITEM CODE **M9**

Also available as a boxed set. $30.

ITEM CODE **M10**

Before going on your next outdoor hike or camping trip, be sure you know North Carolina's reptiles.

Reptiles of North Carolina

Set of 4 posters in full color. Each poster decribes the species and denotes which reptiles are on the endangered, protected or special concern list. A set includes: lizards, turtles, and both live-bearing snakes and egg-laying snakes. Posters are sized 22" x 34". $18. ITEM CODE **P10**

Amphibians of North Carolina

The Hylid Frogs. North Carolina's tree frogs, cricket frogs and chorus frogs, belonging to the large family *Hylidae*, are presented in this colorful poster, one of two frog posters in the Amphibians series. 22" x 34". $6.

ITEM CODE **P11**

Amphibians of North Carolina

True Frogs and Toads. The second poster in the Amphibians series showcases true frogs and toads. Vibrant photos combine with informative text to make it a standout in the classroom or at home. 22" x 34". $6.

ITEM CODE **P14**

Waterfowl Decoys of N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.

ITEM CODE **P12**

Traditional Trout Flies of the Southern Appalachians

Sixteen traditional trout flies are presented in stunning color detail. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. Second in a series of "Sporting Heritage" posters. 22" x 34". $10. ITEM CODE **P13**

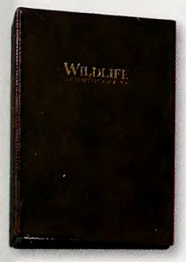
Bird Houses & Feeders: How to Build and Enjoy Them

An eight-page illustrated guide to building bird houses and feeders. $2.

ITEM CODE **M6**

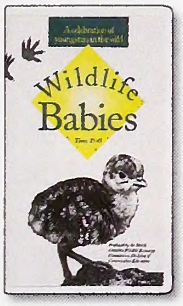
Dogs that Point, Fish that Bite

Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. **$19.95.** ITEM CODE **M8**



Magazine Binder

Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. **$10.**
ITEM CODE **M2**



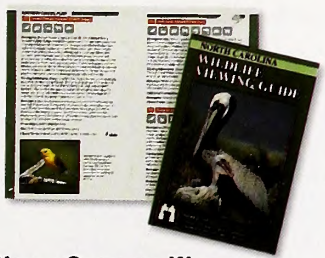
Wildlife Babies Video

Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others . **$20.**
ITEM CODE **N9**

Based on Chief Seattle's 1855 speech, the film's focus is on environmental ethics. Accompanied by This Land Is Sacred, this film is a must-see for everyone. It is destined to become a classic.

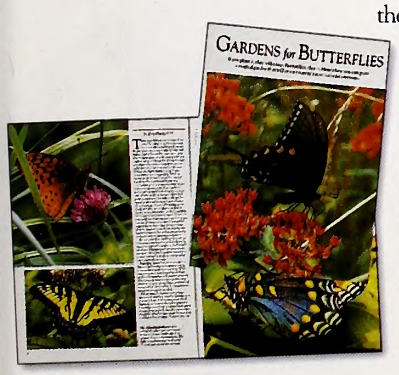
All Things Are Connected

Video and Activity Guide. **$22.**
ITEM CODE **W3**



North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. **$5.95.** ITEM CODE **N6**



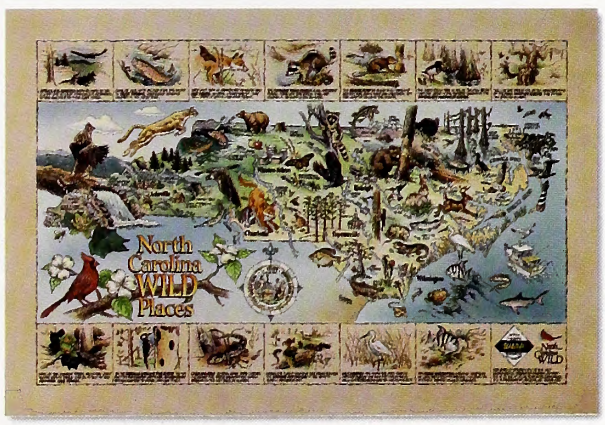
Gardens for Butterflies

Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. **$2.** ITEM CODE **M5**

Scouting Correlations

Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each **$3.**
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**

North Carolina's wildlife habitats come alive in this 82-page, easy-to-read, soft cover book. With delightful illustrations by Anne Marshall Runyon, N.C. WILD Places covers 13 habitats across the state.



North Carolina WILD Places: A Closer Look

Book and Posters Set. With each book you'll receive two habitat posters (also by Runyon) and a N.C. WILD Places Map poster, featuring the art of Jackie Pittman. **$16.** ITEM CODE **E6**

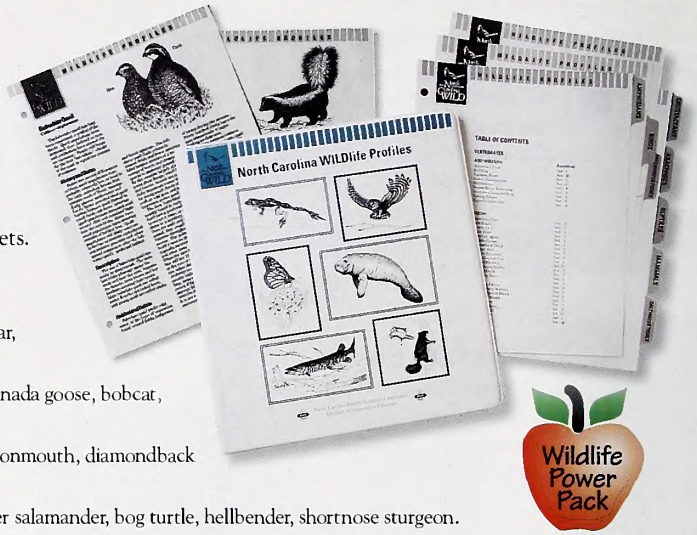
North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. **$6.**
ITEM CODE **E7**

More terrific items ☛

N.C. WILD STORE

Top-quality, 3-ring binder holds 120 WILDlife Profiles. Custom-made binder comes with a table of contents, tab dividers to organize Profiles by classes, an index and 120 fact sheets.



Wildlife Power Pack

WILDLIFE PROFILES BINDER & WILDLIFE PROFILES SETS 1-12

Binder features clear overlay cover, 1 1/2" capacity and inside literature pockets. See the list of species profiled below. $30. ITEM CODE W17

Set 1. Black bear, raccoon, white-tailed deer, striped skunk, bobwhite quail, wild boar, muskrat, mourning dove, coyote, mallard.

Set 2. Mink, canvasback duck, red fox, wild turkey, beaver, American river otter, Canada goose, bobcat, red wolf, cougar.

Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass.

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster.

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat.

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad.

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish.

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet.

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet.

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.

INVENTORY BLOWOUT!

50% off if you order Sets 1 through 10 inclusive. $10. ITEM CODE W4-S
Discount does not apply to purchase of individual sets. Time-limited offer expires Dec. 31, 1999.

WILDLIFE IN N.C. CAPS

Brook trout and magazine logo are embroidered on a sage-colored, premium weight, pigment-dyed, brushed cotton cap with an unstructured front, an extended bill, and a nubuck suede closure. $16.50. ITEM CODE A3

Blaze orange and camouflage hats are embroidered with magazine logo and buck deer silhouette. $16.50 each.

Blaze orange with brown waxcloth bill. ITEM CODE A7

Advantage® Camouflage with tan suede bill. ITEM CODE A6

N.C. WILD CAP

N.C. WILD logo is embroidered on a pro-shape, brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50.
ITEM CODE A1

WHILE SUPPLIES LAST!

100% cotton (preshrunk) T-shirts are guaranteed for comfort and durability. Each shirt features an original design.

PISGAH CENTER FOR WILDLIFE EDUCATION T-SHIRT

Colorful Pisgah Center logo on back. Natural. $14.50.
ITEM CODES:
A8MED (medium)
A8LRG (large)
A8XLG (extra large)
A8XXL (extra extra large)

WILDLIFE IN N.C. T-SHIRT

WINC magazine logo on front pocket. Tundra swan art on back. White. $14.50. ITEM CODES:
A5MED (medium)
A5LRG (large)
A5XLG (extra large)
A5XXL (extra extra large)

N.C. WILD T-SHIRT

N.C. WILD logo printed on front and colorful art on back. White. $14.50. ITEM CODES:
A4MED (medium)
A4LRG (large)
A4XLG (extra large)
A4XXL (extra extra large)

The 2000 North Carolina Wildlife Calendar is Here.

The painting "The Gleaners" by Robert C. Flowers Jr. is a sample of the fine art featured in the *2000 North Carolina Wildlife Calendar*. To order your calendar, see the convenient order form on page 35.

"The Gleaners"
Robert C. Flowers Jr.

courtesy of the artist

2000 October

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4 • Fall bluefish hit in surf	5	6	7 A lifetime license—one of the keys to a successful hunt
8 • Fall channel bass run begins • Sea duck migration peaks	9 *Yom Kippur*	10 • Peak bass fishing at Kerr, Gaston lakes	11 • Hummingbirds begin migration to South America	12 • Canada geese from north arrive *Columbus Day*	13	14
15	16	17	18 • Fall foliage peaks in Mountains	19 • First fall frost in Piedmont	20 • Fall crappie fishing peaks	21
22 • Acorns mature	23 N.C. Waterfowl Stamp	24	25	26	27	28

King of the Hill

With bow-hunting season beginning this month, regal bucks like this won't be out in the open very long. A good hunter learns to work like a detective early in the season. Story on page 8.

Periodicals postage paid at
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CONOVER, NORTH CAROLINA

245
7.63/10

WILDLIFE IN NORTH CAROLINA

OCTOBER 1999 $1.50

Driving Miss Bambi

by Jim Dean ©1999

It was late afternoon and we were headed home for Thanksgiving on a familiar, isolated stretch of N.C. 561. As we rounded the curve and headed down the hill toward a low bridge, the headlights revealed four deer standing in the road. It wasn't a complete surprise because I'd seen deer there before and I had already slowed just in case. Yet, I was still nearly on top of them before I could get the family sedan stopped. The deer at first seemed uncertain what to do, then they moved off on the left shoulder and I began to ease past very slowly on the right. Suddenly, a doe bolted back across the road and ran headlong into the side of the car. She backed up looking a bit dazed, then loped across in front of us apparently unhurt.

KEN TAYLOR

"Is she okay, Dad?" my daughter, Susan, asked.

"I think so," I replied. "We were all lucky."

Certainly, it could have been much worse, and often it is. Accidents involving deer and vehicles are common, and becoming more so. With North Carolina's whitetail population estimated at 900,000—up some 750,000 since 1975—there are few drivers who haven't had at least a close call. Some folks who drive in areas where deer populations are especially high, particularly the eastern part of the state, have had multiple collisions with deer. For whatever consolation it offers, this problem isn't unique to the Southeast. When I visited Colorado recently, I learned that deer collisions are so common on narrow mountain roads that only foolhardy drivers go faster than about 35 mph. In northern Maine, moose are a major traffic hazard.

"Fall and early winter are when deer breed, and their near obsession to mate causes them to lose some of their celebrated wariness."

The August issue of this magazine reported on the high incidence of deer-related vehicle accidents, but it's probably not a bad idea to revisit the subject since we are entering that time of year when such accidents are most common. Fall and early winter are when deer breed, and their near obsession to mate causes them to lose some of their celebrated wariness.

Here are some additional tips that may help drivers avoid collisions. Be especially watchful at dawn and dusk because that's when deer are most active—three-quarters of the collisions occur between 6 p.m. and 6 a.m. Also, more collisions occur on rural roads than on interstates, partly because major roads have wider, cleared shoulders. Drive with your high beams on whenever possible to extend the range of your vision. Deer on the shoulders and in edges of the woods can pose as much threat as those standing in the road because they may leap out in front of you at the last moment. Slow down and be ready to stop anytime you see deer.

Even if you don't see deer, there are some topographical features you should watch for. Deer maintain some degree of wariness even during the rutting season, and they tend to stay close to cover that provides some concealment whenever they are moving from one area to another. Watch for hedgerows, fencelines or similar narrow wooded strips that extend close to the road. In open farmland, such wooded strips lying between large fields may afford deer their only concealed travel cover for a mile or so, and the deer will often use these lanes to approach the road and cross. Small bridges on rural roads are also likely crossing spots because the floodplain along a creek is usually densely wooded. Deer often use the same crossing spots year after year, so it helps to remember where you have seen deer before.

One factor that complicates the situation is that deer have become so accustomed to vehicles that they will graze along the shoulders, ignoring passing vehicles, lights and traffic noise. So, it's pretty much up to us to make all the right moves to avoid hitting them.

Some years ago, researchers thought they had found the solution to deer-vehicle collisions. They mounted mirrors on posts along roadsides at known deer crossing spots. The mirrors were angled to reflect the lights of approaching cars into the woods, supposedly alerting the deer to danger. Unfortunately, this seemed to have little beneficial effect, and may even have spooked some deer into the road.

Those ultra-sonic whistles that you mount on the bumper are suspect, too. Manufacturers claim that they emit a high-pitched noise detectable only to animals (like those silent dog whistles). These whistles have become quite popular, but wildlife biologists say there is no evidence that they work. All I know is that some years ago, I installed a set on the front of my car.

That was right before I hit a deer.

CONTENTS

WILDLIFE IN NORTH CAROLINA

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

October 1999 *Volume 63, Number 10*

page 19

FEATURES

4 **Autumn Glory!** *photographed by George Humphries* ©1999
There's nothing subtle about the mountain ash in fall. It announces the season loudly, its ruby-colored fruit like an echoing shout against the hills.

8 **Shaken by a Living Wind** *written by T. Edward Nickens* ©1999
The passenger pigeon once descended on North Carolina forests by the millions, but no more.

14 **Dress for Success**
written and photographed by Gerald A. Almy ©1999
Once only available in military patterns, camouflage has now become so specialized that a hunter can fill a walk-in closet with outdoor apparel. Here's a guide to help fashion-conscious sportsmen through the jungle of choices.

19 **Surf Fishing Moods**
written and photographed by Joel Arrington ©1999
Cool water and balmy skies—that's what the fall fisherman wants, and surf casting along North Carolina's golden coast is just what dreams are made of.

24 **When to Hold, When to Fold** *written by Mike Gaddis* ©1999
illustrated by Jackie Pittman ©1999
Challenging one special buck is the consummate gamble. So cut the cards, blow on the dice and let the gaming begin.

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Cover *Raccoons are abundant in North Carolina's woodlands today. Photograph by William S. Lea.* ©1999

Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment only by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 919-733-4376. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

Fish That Build Gravel Nests

written by Jeff Beane ©1999
illustrated by David Williams

Have you ever waded your favorite trout stream and noticed large mounds of small stones, neatly piled in the stream as though they were placed there intentionally? They were, but contrary to the belief of some fishermen, the mysterious stone piles are not the work of crayfish, or of industrious children playing in the creek. Those curious gravel mounds are chub nests.

Chubs are a group of minnows comprising several genera, so named for their thick, "chubby" bodies. Gravel-nesting species in North Carolina include the bluehead chub (*Nocomis leptocephalus*), river chub, (*N. micropogon*) and bull chub (*N. raneyi*). There's also the bigmouth chub (*N. platyrhynchus*), creek chub (*Semotilus atromaculatus*) and Sandhills chub (*S. lumbee*). The tonguetied minnow (*Exoglossum laurae*), cutlips minnow (*E. maxillingua*) and central stoneroller (*Campostoma anomalum*) also build gravel nests. Stonerollers may either build their own nests or use those of other chubs. The nests of the common and widespread bluehead chub are probably the most frequently observed.

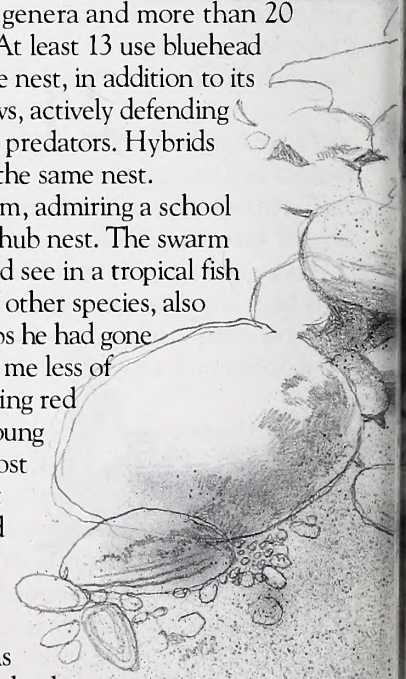
Only the male chub builds a nest. He first excavates a pit on the stream bottom, then covers it with a mound of stones, carrying small ones in his mouth and pushing or dragging larger ones. When he's finished his work, he entices females to spawn over the nest. The gravel helps protect the developing eggs from predators, and the male guards the nest, frequently adding gravel.

Nest size and shape and methods of nest building vary among species. Some nest mounds are quite impressive. Those of the bull chub—North Carolina's largest native minnow—are often 3 or 4 feet in diameter and over a foot high. One river chub nest contained more than 7,000 stones, and its builder was estimated to have swum a total distance of nearly 16 miles within the nest area while gathering them. Some nests contain stones so large it is difficult to believe that such a small fish could have moved them. Creek chub mounds tend to become elongated and ridge-like after several spawnings; one such nest was more than 16 feet long.

If you think that's impressive, so do other fish. Chub nests provide such good egg protection that many other minnow species, particularly shiners and daces, also use them, and several species apparently depend upon them. At least eight genera and more than 20 species of minnows in North Carolina spawn over chub nests. At least 13 use bluehead chub nests, and as many as six have been reported using a single nest, in addition to its rightful builder. Male chubs often tolerate these smaller minnows, actively defending their nests only against rival male chubs or larger, potential egg predators. Hybrids frequently result from such spawnings of multiple species over the same nest.

One day not long ago, I stood by an Alleghany County stream, admiring a school of redlip shiners (*Notropis chiliticus*) spawning over a bluehead chub nest. The swarm of brilliant red and yellow breeding males rivaled anything you'd see in a tropical fish store. Just beneath them were several larger, darker minnows of other species, also using the nest. I could not see the resident male chub, but perhaps he had gone into hiding at my approach. At first glance the scene reminded me less of breeding minnows than of some strange aquatic plant with flowing red leaves, or of a sea anemone's waving tentacles. As I watched, a young northern watersnake came cruising down the creek. It was almost past the spawning fishes when suddenly veering 90 degrees, it plowed into the fray, snatched a male redlip, spun quickly and shot away downstream with its prize.

I was glad for the glimpse of another of nature's spectacular little dramas, which lasted only seconds, but which prompted me for many minutes to ponder the complexity of all ecosystems and the far-reaching effects of a little fish that piles up rocks. Indeed, fish that some anglers traditionally regard as "trash" are actually keystone species in our streams. Without them, the stream ecosystem might fall apart.



Jeff Beane is a curator of reptiles and amphibians at the N.C. State Museum of Natural Sciences in Raleigh.

Other Reading

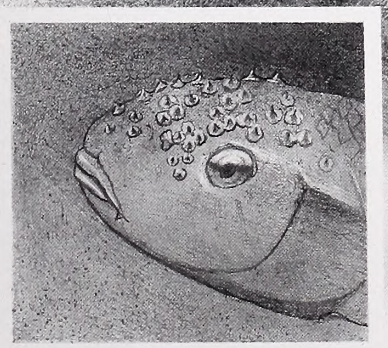
- Robert E. Jenkins and Noel M. Burkhead, *Freshwater Fishes of Virginia* (American Fisheries Society, 1993).
- Fred C. Rohde, Rudolf G. Arndt, David G. Lindquist and James F. Parnell, *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware* (UNC Press, 1994).
- David A. Etnier and Wayne C. Starnes, *The Fishes of Tennessee* (University of Tennessee Press, 1993).

Surfing the Web

- This web site contains information on nest-building minnows. *Address:* http://www.nanfa.org/articles/ACnests.htm
- This web site also contains various information on the life history of minnows, including the creek chub and stoneroller. *Address:* http://www.dnr.cornell.edu/Sarep/fish/Cyprinidae/cyprinidae.html

The stoneroller (Campostoma anomalum) *may build its own gravel nest or use that of a chub.*

The mountain redbelly *dace* (Phoxinus oreas) *rely heavily on chub nests.*



A male river chub (Nocomis micropogon) *adds a pebble to his large nest mound while several other minnow species breed over the nest. Other gravel nests are built by cutlips minnows, creek chubs and bull chubs. The latter species builds nests 3 feet in diameter. Like many minnows , male cutlips minnows* (Exoglossum maxilingua) *(left) develop keratinized tubercles on their heads during breeding season. Tubercles are used primarily for combatting rival males and stimulating females to spawn, but they may also assist in moving stones.*

Moonrise from Cowee Mountain overlook

Autumn Glory!

There's nothing subtle about the mountain ash in fall. It announces the season loudly, its ruby-colored fruit like an echoing shout against the hills.

photographed by George Humphries ©1999

The mountain ash (*Sorbus americanus*) is not really an ash at all. It's a member of the rose family, more akin to the bush in your back yard than the true ash. In fact, there's nothing very ashy about the mountain ash. Its nine to 17 narrow, toothed leaves are displayed alternately along its stem, and they look like a sumac. The true ash, on the other hand, arranges its seven oblong leaves opposite each other. The mountain ash belongs to the same genus as the European mountain ash, which is also not an ash. This proves either that Americans are just as confused as Europeans, or that mistakes die hard.

You can view mountain ash in the mountains of North Carolina at elevations above 4,000 feet. Riding the Appalachian chain from Newfoundland and Quebec to north Georgia, the trees occurs mainly in the high-elevation forests of spruce and fir. Indeed, it seems to grow eagerly among the shattered columns of these evergreens, dead of a combination of acid rain and the predations of an exotic beetle. Yet where these evergreens fall, the mountain ash rises like a phoenix. Natural disturbances like fire or disease open up the forest and enable the seeds lying dormant in the seed bank to reach for the sun. Large groves of the mountain ash are traceable to such disturbances. Impressive displays of the tree found north of the Devil's Courthouse in Transylvania County, and visible from the Blue Ridge Parkway, may have grown up after the great fires of 1925 and 1940.

Like many trees, the mountain ash does not produce a dependable supply of fruit every year. It tends to be cyclical, with heavy crops of fruit appearing perhaps every third year. The fall of 1998 was a glorious season for mountain ash, says photographer George Humphries. Everywhere he went, he found fruit in profusion, making magnificent subjects for his large-format camera.

The fruit is actually not a berry, but is structurally similar

Distant mountains from Craggy Pinnacle Trail

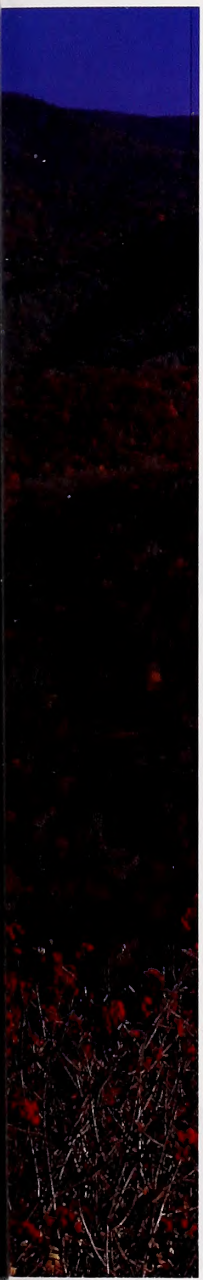
to a very small apple. Songbirds are drawn to the carmine color, although it's not clear what their reaction is when they sample its bitter taste. Nevertheless, the tree provides a steady supply of the fruit all winter. Ruffed grouse also consume the fruit, and black bears have been observed climbing high into the trees to eat it. The tree relies on these animal helpers to disperse its seeds, which then may lie dormant for years waiting for a fire or other disturbance to liberate them.

For American Indians, the mountain ash formed an important part of their vast natural pharmacopeia. Many Indian groups used the inner bark of the tree to make a tea which could be taken for a variety of ailments, including colds, stomach aches, venereal diseases and depression. The tea was also used as a pain killer after childbirth and it calmed colicky children.

Indians also ate the fruits, astringent though they were. In some Indian cultures, the wood was used for the ribs of canoes and snowshoe frames.

As useful as the tree is to birds and people, we appreciate it most at this time of year for its flame-like appearance against the mountainside. As Donald Culross Peattie wrote, "Yet one who has seen it will never forget... how in autumn the berries shone through the changing wood, while the voice of the whitethroat whistled his autumn song—that last farewell to the departing traveler." ⊠

—Lawrence S. Earley



"The mountain ash, decked with autumnal berries that outshine spring's richest blossoms, yields a splendid show amid the leafy woods . . . ."–*William Wordsworth*

Near Clingman's Dome

"Like the domestic Pigeon and other species, they caress each other by billing, in which action, the bill of the one is introduced transversely into that of the other, and both parties alternately disgorge the contents of their crop by repeated efforts. These preliminary affairs are soon settled, and the Pigeons commence their nests in general peace and harmony."—text and painting by John James Audubon, The Birds of America (1827-1838)

Shaken by a Living Wind

The passenger pigeon once descended on North Carolina forests by the millions, but no more.

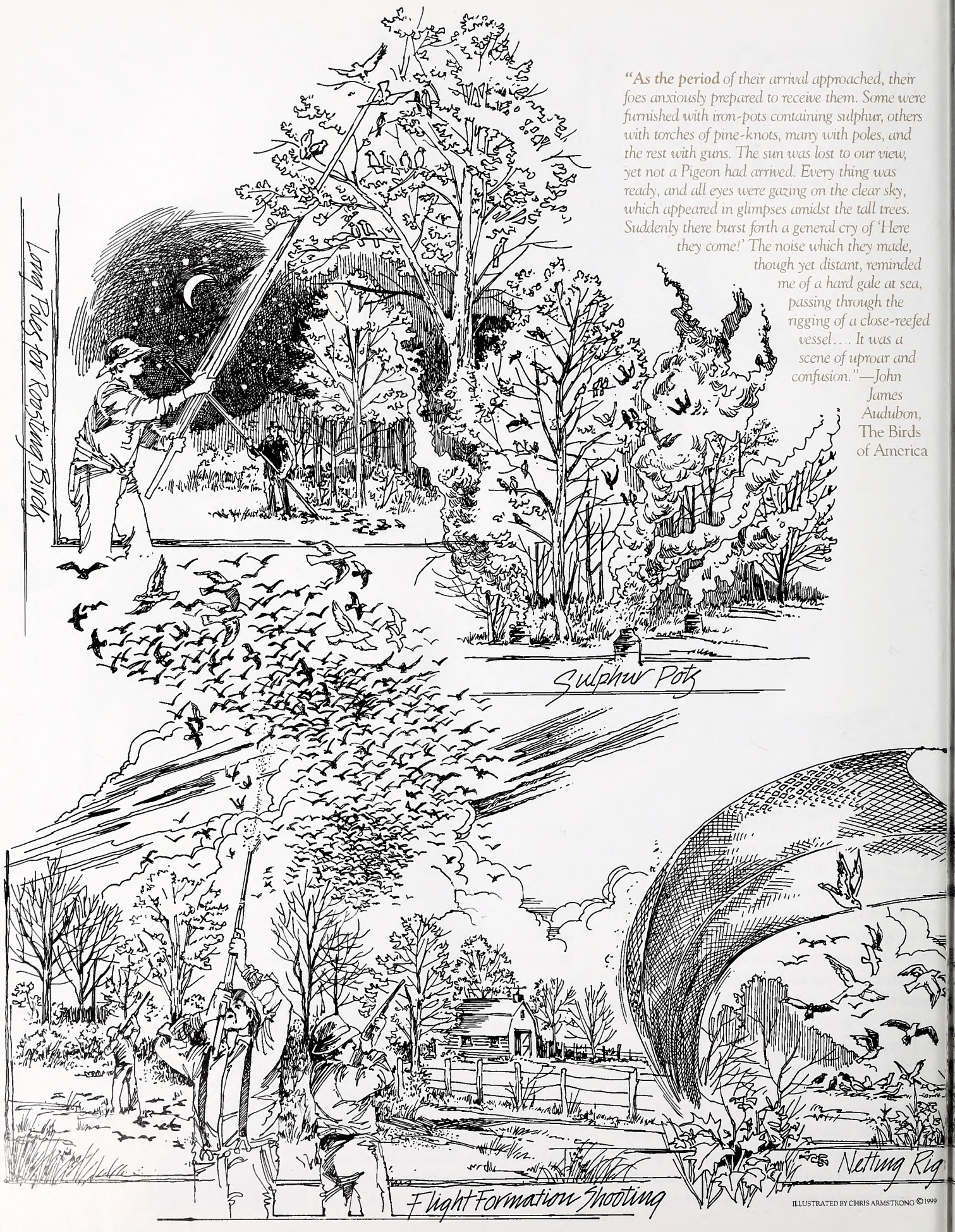
written by T. Edward Nickens ©1999

Even at rest, alone in a stout oak, the passenger pigeon had a certain allure. Dovelike, at over 16 inches in length, *Ectopistes migratorius* was a bit longer than the common domestic pigeon, with pointed wings that stretched 2 feet from tip to tip. Early writers commented on the graceful lines of the passenger pigeon at rest, with its regal, elongated neck and royal adornments, a throat and breast the color of red wine, its cape a mottled shawl of grays and blues, shimmering with copper, green and purple highlights.

But far more impressive than the bird on a limb was the bird in the air, joined by tens of thousands, hundreds of thousands, millions more of its kin. Legend and lore abound about the wandering billions of passenger pigeons, tales of plenty and horrific plunder that fill the three-and-a-half centuries from the first European mention of the bird by Jacques Cartier in 1534 to the final breath drawn by the last of the species, the famous Martha of the Cincinnati Zoo, on Sept. 1, 1914.

Consider the keepers of the Moravian community journals. The band of wandering Europeans had settled in what is now northern Forsyth County in 1753, and they had heard of the great flights of passenger pigeons that swarmed North Carolina during the most bitter winters. But even they could hardly believe the events of the winter of 1760.

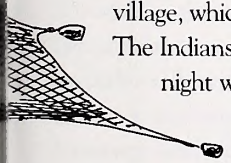
[A]n extraordinary Occurrence happened about the Centre of the Wachovia tract, on a Creek to this day called the Pidgeon Branch, which has the Appearance of an Improbability, yet actually happened, to the great Amazement of the Beholders, viz. an incredible Number of wild Pidgeons assembled there every Night for a Month together, in a small District, perching many fold upon



"As the period of their arrival approached, their foes anxiously prepared to receive them. Some were furnished with iron-pots containing sulphur, others with torches of pine-knots, many with poles, and the rest with guns. The sun was lost to our view, yet not a Pigeon had arrived. Every thing was ready, and all eyes were gazing on the clear sky, which appeared in glimpses amidst the tall trees. Suddenly there burst forth a general cry of 'Here they come!' The noise which they made, though yet distant, reminded me of a hard gale at sea, passing through the rigging of a close-reefed vessel.... It was a scene of uproar and confusion."—John James Audubon, The Birds of America

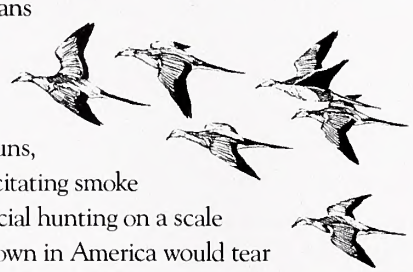
one another, so as by their Weight to break down the largest Limbs of Oaks, bending the Tops of others to the Ground, which was covered more than one foot high with their Dung. The ruins of the Wood as well as the remains of the Dung could be seen several years after. The Noise was so terrible that a Man speaking to his next Neighbor could not be heard without bawling loud, and waggon-loads of Pidgeons killed with Sticks were carried off.

That's right—the passenger pigeon was an unforgettable, if irregular, visitor to North Carolina. The birds thronged across the northern United States until late in the 19th century. In the summertime, passenger pigeons fed on various berries, earthworms and caterpillars. But in the fall and winter, the birds keyed in on acorns and fat-rich beechnuts. During the coldest northern winters the large flocks filtered east of the Appalachians and into the oak woods of the Piedmont, and when they arrived, they did so in all their numberless glory. The flocks fed in the oak woods like snow geese in the beanfields of Perquimans County, an advancing front of birds, those in the rear hopscotching over the leading edge, the forest clouded with flying twigs and leaves. In 1728, William Byrd wrote that "in their Travels they make vast Havock among the Acorns and Berries of all Sorts, that they waste whole Forrests in a short time, and leave a Famine behind them for most other creatures." In 1701, John Lawson, in the company of Saponi Indians on the Yadkin River near present-day Salisbury, went to shoot a roost of passenger pigeons that were "so numerous in these Parts that you might see many Millions in a Flock; they sometimes split off the Limbs of stout Oaks, and other Trees, upon which they roost o' Nights." Lawson reported that the Indians had 100 gallons of pigeon fat stored in their village, which they used as a sweet butter. The Indians ventured into the roosts at night with torches, killing thousands of birds with long poles.



In the Moravian diaries, years pass with no mention of pigeons in the Piedmont, and then suddenly notation is made of flights of stupendous proportion. In 1761 the pigeons were so numerous, and resided for so long, that the locals seemed relieved when 2 feet of snow "at last drove the wild pigeons away, after two months." Other notable roostings occurred in the winters of 1799; of 1806 when "near Salem alone many thousands were killed with sticks at night;" of 1814, when the birds were first referred to in the Moravian records as "passenger" pigeons; and of 1816. Sometime between the 1806 and 1814 roostings, the Moravians traded sticks for guns as the collecting device of choice.

This latter detail hints at the future for the passenger pigeon as a species, for never on this planet has a creature been more harried than was this graceful speedster. "When I saw such Flocks of the Pigeons I now speak of," wrote John Lawson of his pigeon shoot near the Yadkin, "none of our Company had any other sort of Shot, than that which is cast in Moulds, and was so very large, that we could not put above ten or a dozen of them into our larger Pieces; Wherefore, we made but an indifferent Hand of shooting them; although we commonly kill'd a Pigeon for every Shot." It would not take the new Americans very long to devise an impressive list of ways to overcome that handicap. In time, the long poles of the Indians and Moravians would be replaced by a battery of shotguns, nets and incapacitating smoke fumes. Commercial hunting on a scale never before known in America would tear through the great flocks of passenger pigeons like a terrible, relentless, centuries-long typhoon, until the birds were wiped from their roosts and then from the skies.



Only a small part of the killing took place in North Carolina. We've read of the Moravian settlements and their pigeon shoots, of John Lawson's gunning in 1701, of the Indians' taste for pigeon fat. But large pigeon flights to North Carolina were too sporadic to support much but a harvest of occasional opportunity. The commercial trade in passenger pigeons centered on the great nesting and roosting regions—Michigan and Wisconsin, Pennsylvania and New York—far from our borders. Yet what took place there directly impacted the flocks that made their magnificent, if irregular, forays into North Carolina. What happened there is the reason that the birds are no longer here.

First for trail food, then for the farmer's table and smokehouse, the harvest of passenger pigeons was a local phenomenon for many of the early years of settlement. Later came the railroad. Rail lines linked the bird's hinterland home with the tables of Chicago, New York, Boston, Milwaukee and allowed

professional pigeoners—up to 5,000 of them during the market's zenith—access to distant gunning grounds. After the first quarter of the 19th century, the sport of pigeon shooting came into vogue, adding more pressure on pigeon flocks. Live passenger pigeons brought about $70 for a thousand birds, and they were shipped from the Midwest to eastern shooting matches in which 10,000, 20,000, sometimes 40,000 pigeons were summarily dispatched. Many of these were likely domestic pigeons, but untold numbers were certainly wild birds, trapped, transported, stuffed into spring-loaded launchers, blasted skyward, then cut down by shooters paying 20 to 30 cents per bird for the privilege. Early in the market-hunting era, progressive-thinking Ohioans attempted to limit the take of passenger pigeons, but in 1857 the legions seemed too vast, too immeasurable, too infinite to even seriously merit such a thought. The state senate rejected the measure, reporting that "no ordinary destruction can lessen them."

But this was no ordinary destruction, for pigeon killing was perfected with awesome efficiency. The passenger pigeons' habit of roosting and nesting in flocks numbering in the billions and measured by the square mile made them easy targets. Netting was one preferred method, and netters relied on both simple and exquisitely designed sets to snare birds. Some nets were simply strung through the woods or atop hills in known roosting sites, where, for all intents and purposes, the birds were seined from the sky like shrimp. Clapnet operators often manned three netting "beds," made either of mud laced with saltpeter and aniseed, or dry earth baited with corn. A net was set using springpoles that would catapult the mesh over the netting bed when a sufficient number of birds had alighted. A "stool pigeon," or live decoy, was attached by cords that allowed the netters to flap its wings to attract passing flocks. Its eyes were sewn shut to prevent it from attempting escape. It was a deadly combination. A good netter could make as many as 10 "strikes" a day, and 300 birds per strike was considered a bag worthy of comment, although averages varied considerably. Netting a thousand birds in a single strike was not uncommon. Once ensnared, each passenger pigeon was killed individually, its neck crushed with a small pair of pincers whose jaws were bent so that they did not quite meet.

One particularly primitive method of capture was the practice of burning sulfur in metal kettles and coffeepots beneath the nesting trees. Birds young and old were stupefied by the fumes and fell to the ground in heaps. In the beech forests of the North, loose bark was set afire to scorch young birds that could not fly and force them to leap from the nests. At times, grain soaked in alcohol was used to bait the birds, which then flopped around too drunk to escape.

Human ingenuity rose to the task of devising ways to kill more with less. Some gunners dug long, shallow trenches, laced the depressions with bait, then fired down the trench to kill as many birds as possible with one shot. Others assembled long crosspoles in the tops of trees to provide pigeon perches, then enfiladed the resting birds. Shooting the pigeons as they slept, as they nested, as they flew—this was the preferred method of harvest.

When all these agents of destruction were assembled at a single roosting, the result was carnage on a scale that the natural world had never seen. Near Petoskey, Mich., far up the state's fat finger that pushes between Lake Michigan and Lake Huron, the passenger pigeon staged what has been called its "final grand nesting," and "the last great rendezvous." It was 1878. The roosting site was 40 miles long and 3 to 10 miles wide. Suitable trees held scores of

Painting of passenger pigeon by Mark Catesby, from his Natural History of North Carolina, Florida, and the Bahama Islands (1731-1743).

Source: North Carolina Collection, UNC Library, Chapel Hill

coarse, twiggy nests tucked close to the main trunk stem. In each nest lay a single egg.

According to H.B. Roney, a professor and conservationist who early on fought for pigeon protection, the shipment of birds from the Petoskey nesting to market began on March 22 and continued until August 12. It was 20 weeks of almost unbelievable killing and capture. Five hundred pigeons could be packed into a single barrel, and an average of 25 barrels, or 12,500 birds, were shipped out each day. Live birds were packed six dozen to a crate, and 1,116 crates of those were shipped. It's a gruesome arithmetic, if you're up to the task: More than 1½ million birds, Roney reported, wound up in wooden barrels. Add in those killed but not collected, killed and carted home by gunners, killed and shipped by steamship (Roney suggested that just as many were shipped by water as by rail), and the total climbs to 2 million to 3 million birds from this single nesting. Critics have wrangled over Roney's figures, but even they agree that well over a million birds were shipped from northern Michigan. It was no anomaly. Shipping records from the pigeon trade routinely cite figures with six and seven digits.

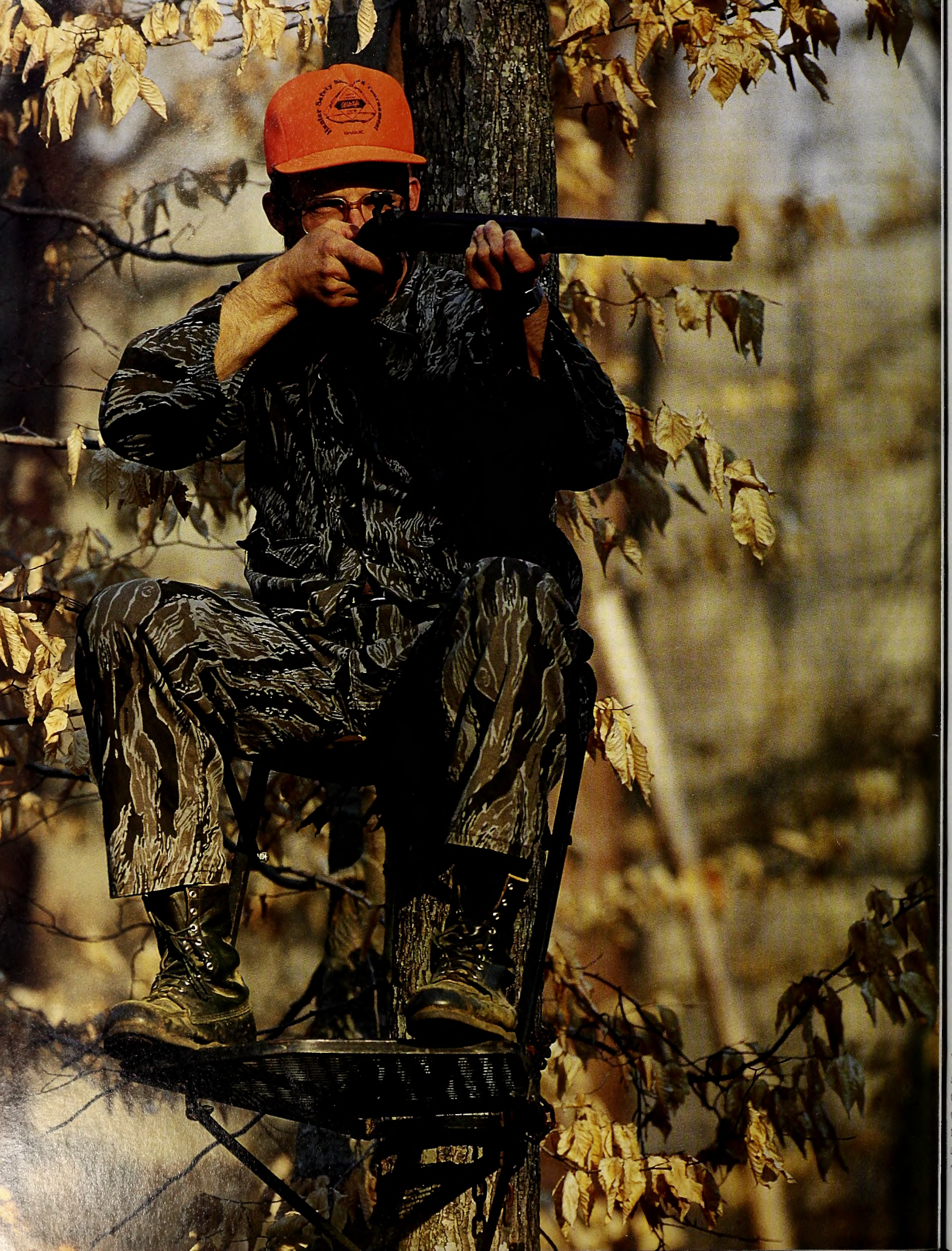
The results of such harvest levels were predictable, at least from our perch on this side of the pigeon's extinction. Before the end of the 18th century the birds' numbers were greatly diminished in the East. By the turn of the 19th century, writers were already noting decreased flocks in Quebec. The killing only increased as railroad lines latticed the Northeast and Midwest, and telegraph lines put professional pigeoners in constant touch with traditional nesting and roosting regions. In the 1870s and 1880s, the birds went into a precipitous decline. In 1882 one man shipped some 2 million pigeons from a single Wisconsin nesting. Just a decade later, the bird was rare. When the American Ornithological Union met in New York in December 1909, the group offered a reward of $1,220 for the recovery of a wild passenger pigeon nest. The jackpot was bumped up over the next few years to at least $1,000 more, but there were no takers. The search was halted on October 31, 1912. The pigeon was gone from the wild. At the time of the Petoskey nesting, the birds were still imponderably abundant. Within the lifetime of a single man, the passenger pigeon vanished.

The great pigeon roosts vanished from North Carolina half a century before Martha's death. The Moravians recorded a roosting in 1816, then no more. There is a report of a roosting 4 miles square in Surry County in the winter of 1842; the birds stayed 17 nights, wrote William Holland to his son Francis, then a Moravian missionary in Jamaica. Then the pigeons "left and flew over the mountains." In their landmark *Birds of North Carolina*, T. Gilbert Pearson and the Brimley brothers recorded one of the final sightings of the passenger pigeon in North Carolina. They were told of a flock "about a mile wide" thronging across Alamance County in 1871 or 1872. There are three records of small numbers of pigeons in the state in 1880. On April 18, 1891, H.H. Brimley followed a single bird for hours through pinewoods near Raleigh. Three years later, a female was collected in the mountains near Weaverville. That was it. No more, at least not in North Carolina.

Today the passenger pigeon makes an impression not because of its numberless legions but because of the numbing reality of its extinction at man's hand. Gone are the feathered rivers in the sky, the thunderous roosts with their crackling timber. Gone forever is the passenger pigeon. Oddly, sadly, what the Moravians wrote about the birds' magnificent arrivals in the forest hills of the Piedmont can be said about its extinction. It "has the Appearance of an Improbability, yet actually happened, to the great Amazement of the Beholders." ⊠

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

This plaque on a monument at Wyalusing State Park in Wisconsin memorializes the last of the passenger pigeons. About the monument, conservationist Aldo Leopold wrote: "Men still live who, in their youth, remember pigeons. Trees still live who, in their youth, were shaken by a living wind. But a decade hence only the oldest oaks will remember, and at long last only the hills will know."



Dress for Success

Once only available in military patterns, camouflage has now become so specialized that a hunter can fill a walk-in closet with outdoor apparel. Here's a guide to help fashion-conscious sportsmen through the jungle of choices.

written and photographed
by Gerald A. Almy ©1999

The use of camouflage *for hunting is as old as the sport itself. Indians used to wear the hides and heads of prey to sneak within bow-range of a herd. But with the invention of longer-range weapons came the need to only blend in with natural vegetation.*

Other than a gun, bow and binoculars, few pieces of gear are of greater importance to the modern hunter than camouflage clothing. For archers, waterfowlers and turkey hunters, camo is a virtual necessity. For rifle hunters, it is not quite as vital but occasionally it can mean the difference between failure and success when waiting for quarry to come within range.

But camouflage does more than just make you inconspicuous. It helps you achieve one of the fundamental goals of hunting: to become a part of the natural world by assuming the role of the predator.

Even when blaze orange is required or recommended, as it is for much hunting today, camo can play a part in your hunting. There is no mandate that says you must dress from head to toe in the orange safety color. A vest or hat is enough to meet legal and safety requirements. The remainder of your clothing can be total camouflage. If you have ever seen a hunter clad in a full-length jumpsuit, you'll know the difference I'm talking about.

The widespread use of camouflage for hunting is a fairly recent phenomenon. When North America was being settled, game was perhaps less wary, and the need for camo not as great. But with more people coming in contact with wildlife, we have warier animals to contend with, and camo is an advantage hunters cannot afford to forego.

With the new interest in camo has come a new complexity. No longer are there just two or three basic types to choose from. You don't just drive down to the nearest hardware store and purchase a pair of World War II pants and shirt. Instead, there has been an explosion in camouflage theory and special-purpose patterns. One major sporting goods company sells no fewer than 26 different patterns of camouflage. Some are applicable to North Carolina hunting needs; some are not. I've been fascinated with camo for years and have discovered that some designs are best for certain types of hunting, and others are totally inappropriate.

Camouflage for the hunter or photographer is designed to break up the solid image of the human form and make the wearer blend in with his or her surroundings. It does this by using various blotchy, linear,

***Though this hunter** dons the appropriate clothing to match late-summer vegetation, the same camouflage will be much less effective during autumn. Specialized camo is tailored to fit most any situation, including snowy backgrounds, winter woods, lowland swamps and frozen marshes.*

leaf or branch-shaped patterns to allow you to blend in with leaves, trees, rocks and bushes. The better camouflaged you are, the closer you can get to your quarry, and the longer you can avoid being detected by it. That translates into more time to look over the animal, make sure it is what you want and raise the gun, bow or camera for the shot.

Although there are many different designs available, there are also many different landscapes a hunter or photographer might want to blend in with. Some of the more common settings include dove fields, late-summer woods, autumn woods, winter woods, spring woods, snowy habitat, stony mountain areas, deep lowland swamps, timbered marshes and grain fields.

Indians used skins of the animals they were pursuing for some of the earliest camouflage. Instead of trying to blend into vegetation, trees or rocks, they donned a deer or buffalo hide and approached their quarry as if they were one of the herd.

More recently, military camouflage was adapted by hunters and used to help them blend in with their habitat. The World War II pattern of oval, squiggly blobs of tan, dark green and brown was developed by a Belgian in 1942 and is among the most popular patterns of traditional camouflage. Another version, called "Woodland," was developed later by the U. S. Army. It has black, brown and two shades of green in a more erratic pattern, with larger blocks of color, longer blobs and a less-spotted look than the World War II version. It was developed as a mostly green pattern, but is now available in browner versions to match the surroundings found in late-fall hunting. A white, black and gray variety is also made for hunting in snowy woods.

These camouflage patterns work fairly well for some types of hunting, but the theory behind their design does not make them particularly appropriate for modern hunting needs. They were designed to fool humans, not wildlife. They were not intended to totally conceal a person but just to break up the outline of the human form. Another problem is that these camos were made for military use in countries with vegetation different from that of North American hunting terrain.

The first person to develop a totally new version of camouflage was Virginian Jim

Crumley. After years of experimenting and research, he developed Trebark. It has revolutionized camouflage for hunting. Crumley's camo was invented strictly for pursuing game, with the typical woods of the eastern United States as the background he wanted to blend into. And the eyes of game were the ones he wanted to fool—not enemy soldiers'.

As a turkey hunter and archery deer hunter, Crumley had been dissatisfied with how the traditional World War II and Woodland camo patterns performed for him. "The camo available was strictly for military use in heavy jungle vegetation," he said. "Yet, simply because it was called camouflage, I was wearing it to trick deer and turkeys."

In 1975 he began to design his own pattern that would make him less conspicuous in the woods. "I got especially motivated when a deer nailed me even when I knew I hadn't moved and it had not smelled me," he said. "I began making doodle sketches that included traditional camouflage colors of brown and green in realistic leaf designs, as well as bark patterns and branch and twig designs.

"I abandoned the leaf-pattern sketches because they were too seasonal," he added. "I gave up the branches because I felt it would be difficult to make a man look like a bunch of twigs. The decision to use the bark pattern was made because the human form lends itself well to it."

Crumley believed that the pattern should be black, gray and brown, because "these are the colors nature provides most often in birds and animals that depend on visual deceit for survival," he said.

Trebark was revolutionary because of its colors—emphasizing gray, brown and black—and its linear design that blended in with tree trunks and rocks instead of leaves and bushes. It made sense logically, and it worked. After he used it successfully himself for several seasons, Crumley began marketing the camo line in 1980 and it quickly became a hit with hunters.

A few years later, Georgia's Bill Jordan introduced yet another important new camouflage—Realtree. To design the pattern, Jordan said he "chipped bark off trees, then took it to the paint store and tried to match the colors. One of the things I strived for with the pattern was to create the illusion of depth," he said. Realtree also introduced the use of leaves and horizontal limbs over a background of bark.

At about the same time, Toxey Haas, of Mississippi, introduced his Mossy Oak pattern to match the southern bottomland hardwoods where he hunted. Crumley, Jordan and Haas have been the leading camouflage makers over the past decade, but many quality companies have entered the scene, resulting in a number of new designs.

Narrowing Down the Choices

Suppose you find the assortment of camouflage available just too bewildering and want a few effective patterns to use. Here are some you can't go wrong with, though these choices certainly don't imply that other manufacturers' products and smaller companies' offerings aren't also useful.

General-purpose hunting: In my opinion, the best three are Jim Crumley's Sniper, Bill Jordan's Realtree X-tra Gray and Mossy Oak Break-Up. These three are all fairly new, work well in rocky, brushy and mature forest backgrounds and are easy to find in most sporting goods stores and mail-order catalogs.

Spring hunting: Realtree X-tra Brown is a new pattern that actually has far more green in it than you would expect. Also, it is good for late-summer and early-fall hunting, when lots of green foliage is out. Mossy Oak Shadow Leaf is another pattern that has lots of green and works well for spring or early fall.

Tree-stand hunting: All-purpose camo patterns are good, but so are the old original tree and bark designs such as Jim Crumley's original Trebark and Mossy Oak's Bottomland and Treestand patterns.

Waterfowl and dove hunting: For hunting in traditional wetland and marsh settings, try Advantage Wetlands, Skyline Fall Flight or Mossy Oak Shadow Grass. These also work well for dove hunting if you're in or next to grain fields. Otherwise, you probably should go with one of the all-purpose patterns.

Any person hunting bear, deer, wild boar, rabbit, squirrel, grouse, pheasant and quail with the use of firearms, must wear a cap or hat made of hunter orange material or an outer garment of hunter orange visible from all sides. —*1999-2000 Regulations Digest*

For example, hunters complained that they were not always in dark gray woods. During early-fall bow hunting and late-spring gobbler hunting, woods are dominated by green leaves on saplings and brush. Therefore, manufacturers came out with overlays of leaves on the bark backgrounds. Mossy Oak developed Treestand and Full Foliage, then Break-up. Jim Crumley came out with Universal and then a pattern called Sniper. Kelly Cooper unveiled his Tru-Leaf, which features silk-screened beech, maple and oak leaves, plus acorns and twigs. Bill Jordan unveiled Advantage and then X-tra, which are three-dimensional patterns. Browning, Remington, Skyline and Columbia came out with specialized waterfowl patterns such as Fall Flight, Cattail, Delta Marsh and Marsh Grass.

The main thing to consider when choosing from this multitude of camouflage is the habitat that you are hunting or shooting photos in. If the terrain has lots of brush or

A bowhunter (left) *performs some quick scouting before heading for the woods. Due to the close-range nature of archery, hunters typically camouflage their face with paint (below) or a cloth mask.*

saplings that are leafed out, choose one of the patterns that has leaf overlays and the appropriate colors in it. If you are hunting in a reedy marsh area, choose one of the special wetland camo patterns. These perform well for dove hunting, too. If you are hunting in a tree stand leaning against a large trunk, the original Trebark, Realtree and Mossy Oak patterns still work well, as do the more updated versions with overlaid images of leaves and branches.

Don't be afraid to mix and match patterns, either. I think this breaks up the human form even more. Sometimes I'll wear a bark-type camo for pants and a leaf overlay pattern for a shirt or coat, to look like the trunk of a tree and the foliage above it. It's not necessary to buy a half-dozen different patterns, but most hunters who participate in several different types of sport will want two or three different varieties (See "Narrowing Down the Choices.")

Besides clothing, face and hands should also be camouflaged if you are going after particularly wary game such as spring turkeys. You can use face paints, or powder such as Tink's Camo Dust, or simply wear a camouflage mask and gloves. Many hunters also like to camouflage their guns and bows as well, either with tape or spray paint.

When dressing in camouflage, it's important to remember small things like socks and T-shirts. Don't wear a white undershirt or socks. They don't have to be camouflaged; gray, brown, green or black ones will do.

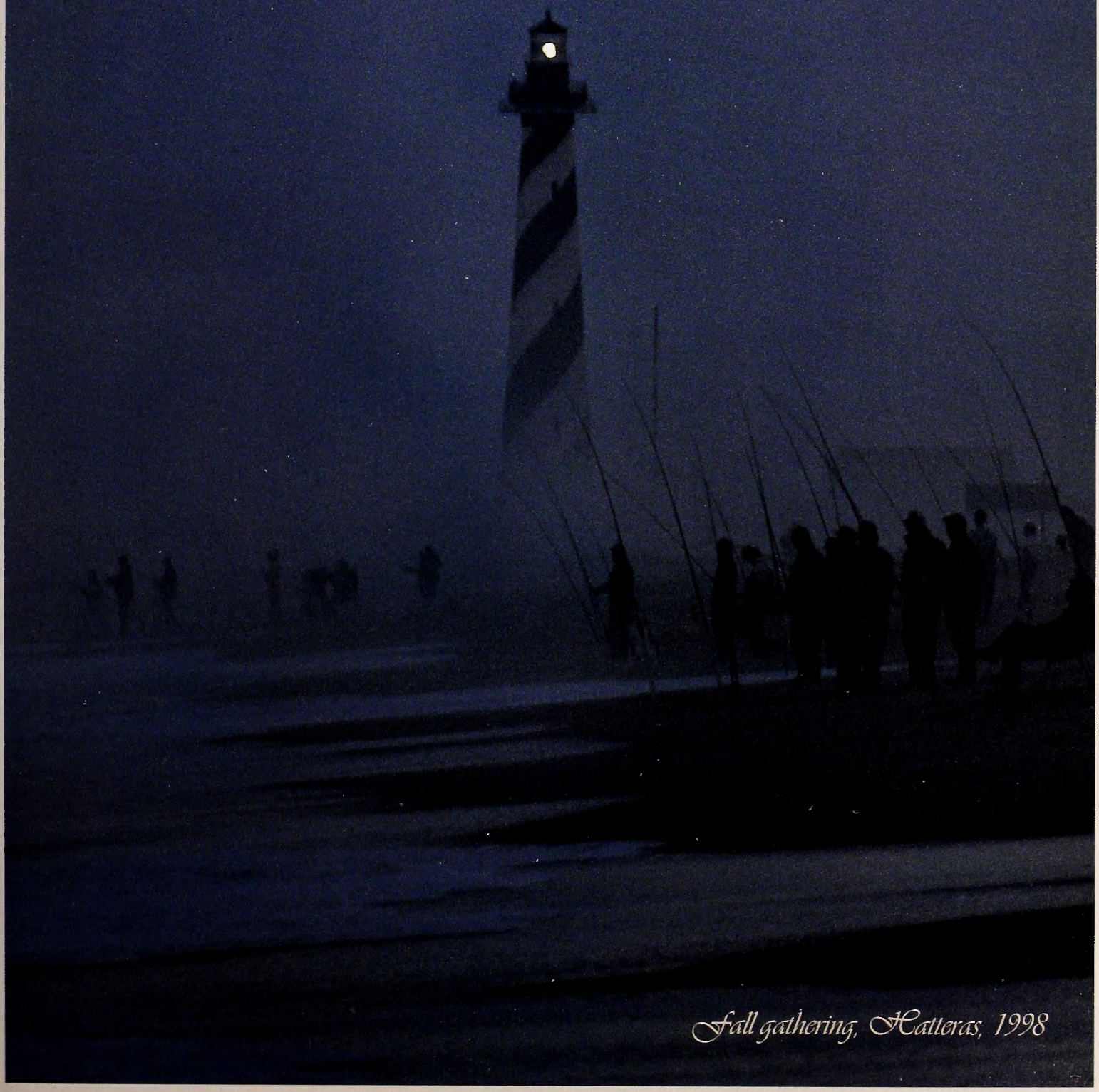
Material for camouflage is a matter of personal choice. Many hunters favor the new synthetics. I personally like the softness and silence of cotton, particularly chamois. When it's colder, I turn to wool. But the synthetics are in many ways more efficient, if you prefer them. Whatever fabric you choose, make sure that it's warm enough, durable and reasonably quiet.

Chosen properly, camo can enhance the pleasure of the hunt by allowing you to blend in with your surroundings and become part of the natural world. But always keep safety in mind, as well. If the situation calls for it, add a blaze orange vest, hat or ribbon wrapped around a tree to spell out your location to nearby hunters. A bit of orange won't give you away to most game if you remain motionless and quiet—the best camo of all. ⊠

Surf Fishing Moods

Cool water and balmy skies—that's what the fall fisherman wants, and surf casting along North Carolina's golden coast is just what dreams are made of.

written and photographed by Joel Arrington ©1999



Fall gathering, Hatteras, 1998

Red drum from the surf

Warmth progressively leaves the sea, and by year's end, winter comes down in icy storms and gray, windy days.

Morning blitz

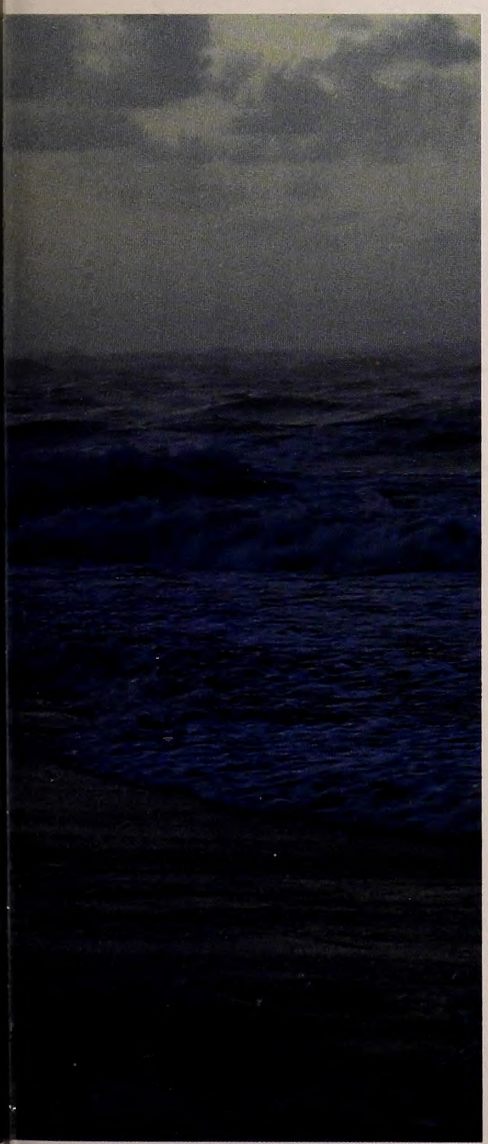
One day in late summer, anglers along North Atlantic barrier island beaches feel the wind change and notice that the air is drier. Sunlight, now from a lower angle, has lost some of its heat. Mornings and evenings soon grow cold. We become most aware of the sea's remarkable biological production as the days grow shorter and the continent begins to cool. Bait appears on schedule. Schools of finger mullet and smaller glass minnows move out of the bays and through the surf zone. Vast schools of menhaden exit Chesapeake Bay and Pamlico Sound, ghosting south like dark shadows. With the bait come the predators—trout and mackerel, bluefish and drum.

The avian cast of characters changes, too. Dark cormorants arrive in number and trade across the islands and out to sea. New varieties of shorebirds alight and forage in the wash among our rods standing in their surf spikes. Dainty and quick, they run ahead as we slog in clumsy waders. Taking flight together when alarmed, they tilt as one to show alternately their white bellies and gray backs. They wheel away only to spiral down again a short distance away, hungry, needing fuel for their long flights south.

Warblers flit through the myrtle and juniper behind the beach as they stage for their migration to the West Indies. What genetically coded faith or courage compels them to launch a flight over the gray ocean to such a distant and unknown destination? What winds help or hinder?

At this latitude, a southwest wind prevails all summer, until the first fall northeaster reverses the trend, refreshing land and sea. North of Cape Hatteras, a southwest wind blows offshore, drives warm surface water away from the beach and draws up cooler and more nutritious water from the depths. The result through much of the year is cooler water along the beach north of the cape than south of it. Cape Hatteras, experts say, remains a biological dividing point between many northern and southern species.

An eddy of the cold Labrador Current flows inshore from the north, further tempering the mid-Atlantic surf zone. Its collision with counter-currents at Hatteras deposits waterborne sand and forms the cape and notorious Diamond Shoals, bane of shipping for 500 years. Turbulence there traps migrating bait, which attracts predators and accounts for one of the most productive fishing locations in the world.



The fall fisherman seeks cool water. Late-summer temperatures in the 80s can be tolerated by gamefish species that migrate up from the south—the Spanish mackerel, pompano and tarpon—but by the end of October, they have departed for the tropics. Now we look for fish whose comfort range extends to the 60s and below—the bluefish and red drum and false albacore, the speckled trout and weakfish, spot and croaker. Fish are the ostensible draw, the alleged object of fall surf fishing, but we return every fall for more than fish.

Conditions change. Only a remnant of giant bluefish populations remains in the western North Atlantic. The species reigned for over 20 years until recently, bringing memorable and often frenzied fishing to thousands of beach anglers. If the historical pattern holds, big blues will return in former numbers to excite future generations of

Bluefish on bait

anglers hip-deep in the surf.

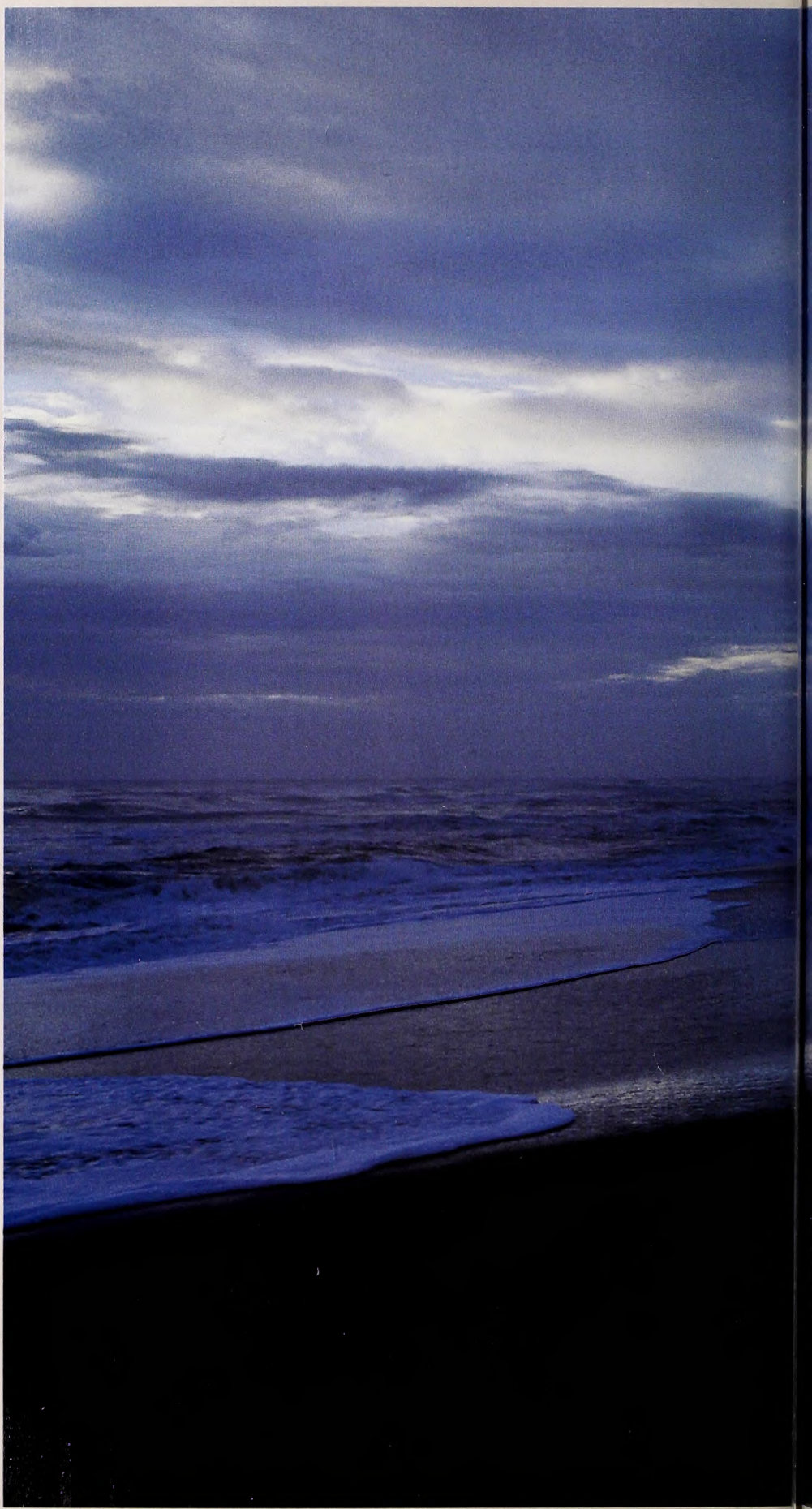
North Carolina red drum fishing has been better in the past, but big fish still cruise the beaches during the fall. New regulations to protect the stock allow anglers to keep one fish between 18 and 27 inches per day.

Some of Chesapeake Bay's speckled trout migrate down the North Carolina surf zone in the fall. Some anglers believe that the trout swim at least as far as Cape Lookout, but tagging studies have not confirmed that. Trout originating in Pamlico Sound also forage into the ocean. Even anglers without vehicles can walk over the line of dunes early on a November morning to cast a plug with a light rod into a narrow slough. With luck you may have the spot to yourself, but odds are diminishing. Success in solitude with good-sized specks has become for many the quintessence of Outer Banks surf fishing.

Flounder stocks, thanks to a successful management plan for summer flounder, continue to improve. As a result of good management and moderate water temperatures, striped bass fishing in the Outer Banks surf last winter was reminiscent of some of the good years past. Stripers have been known to lie dormant when the water gets too cold, resistant even to live baits.

Warmth progressively leaves the sea, and by year's end, winter comes down in icy storms and gray, windy days. Surf fishing becomes unproductive for long periods, but any winter can bring a few days of warming southerly winds. Adventurous anglers drive out on windswept beaches to try their luck and occasionally find it good—a striper here, a trout there. Rarely, we will drive up on a seal that has crawled ashore to rest and soak up the sun. Wary of the only motor traffic all morning, it humps rapidly back into the surf and disappears as we pass.

With the exceptions noted, anglers at this time of year are only marking time, content in the knowledge that winter sets the stage for spring. ⊠

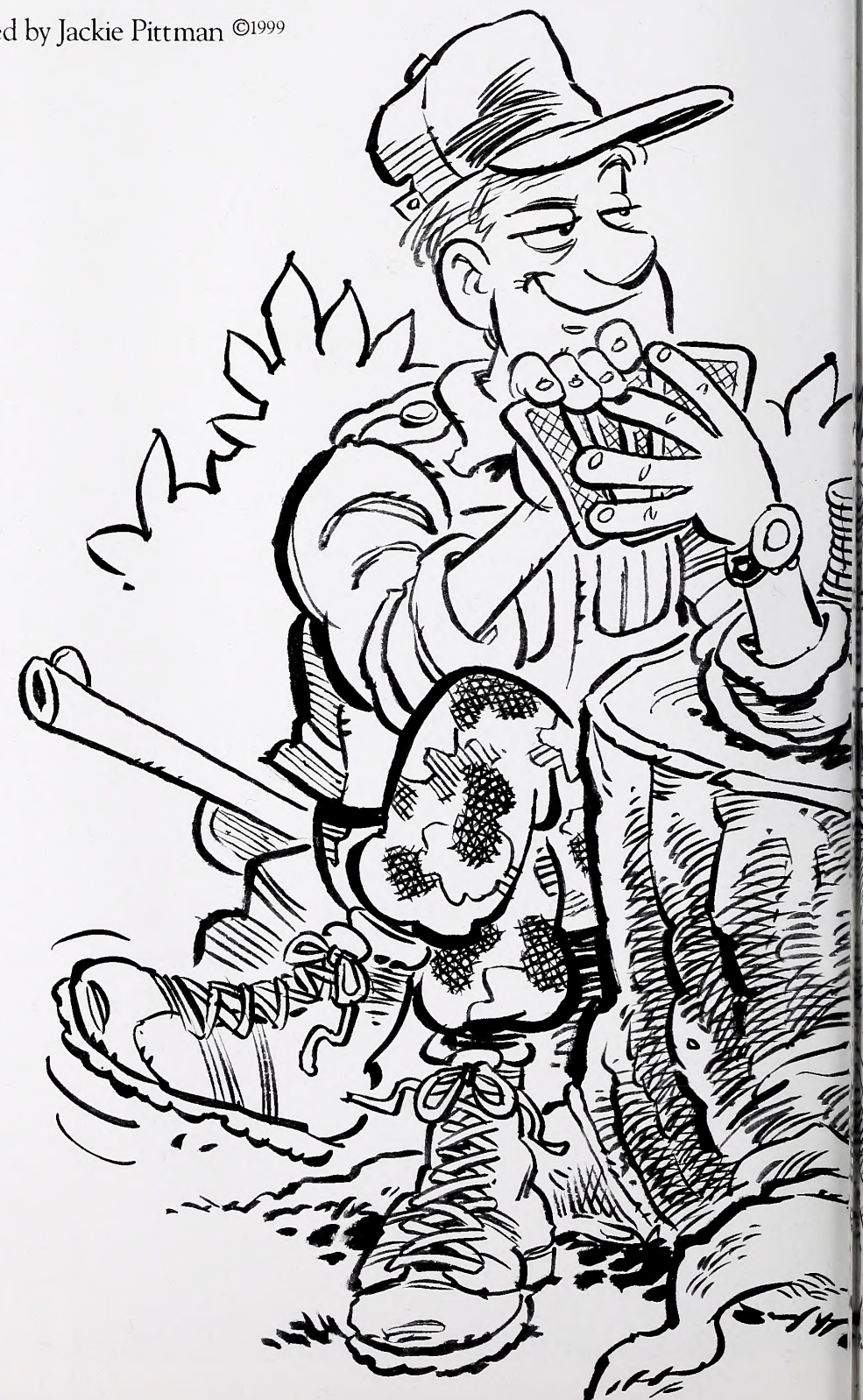


Hatteras at dusk

When to HOLD,

Challenging one special buck is the consummate gamble. So cut the cards, blow on the dice

written by Mike Gaddis ©1999 /illustrated by Jackie Pittman ©1999



The sight of a tree shredded by a large rack is to hunters like a flashing neon sign on a casino. It says: come on in... if you're feeling lucky. And any self-respecting hunter willingly accepts the challenge, knowing full well he'll be playing a game where the deck is stacked, the dice are loaded and few ever hit the jackpot.

A duel with a commanding whitetail is an odds maker's dream, the consummate gamble. It's the world championship of chess, played on a tipsy checkerboard; it's a game of poker, where you're the only honest player. For the most part, a seasoned buck chooses the game, brings the dice, breaks the deck and generally holds the ace-high straight. He charms more females than James Bond, runs a granite-eyed bluff and wields a black-belt in narrow escapes. The rules change daily, and every element under Heaven's Kingdom scrambles to rig the wheel.

Trump cards come scarce, and you'd best count your chips before you throw one. Knowing when to hold and when to fold is the difference between bank or bust with high-stakes bucks. It's both timing and tactics, and the ability to constantly read the cards, while hedging your bets against staggering odds. And what it all boils down to is placing yourself in a position to win, hoping he falters and you don't.

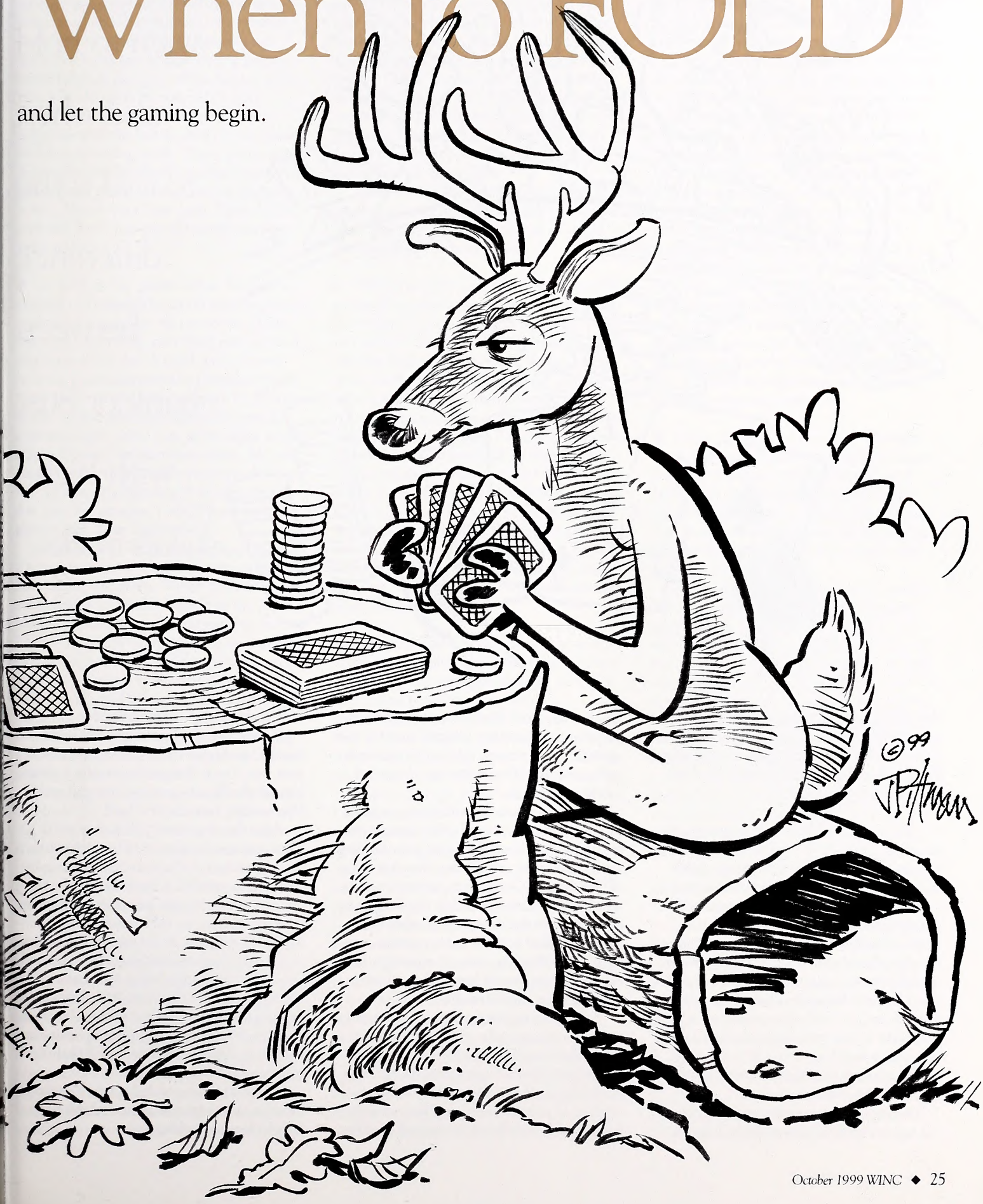
♣ Sizing up the players. Most encounters with a trophy whitetail begin with a discovery during post-season scouting.

Find a signpost rub in winter and you're already ahead. It's a tip-off that betrays your antagonist's edge, allows a counter-scheme, and sets up the all-important element of surprise.

With it, you establish the wellspring of a buck's travels, the proximity of his bedding area, and a core area presence for more than one rutting cycle. A signpost rub denotes an extended rub line, old scrapes and a preferred pattern of travel, at least from the preceding fall. An impressive shed confirms

When to FOLD

and let the gaming begin.



"Knowing when to hold and when to fold is the difference between bank or bust with high-stakes bucks."

that the animal lived beyond the hunting season. With this much up your sleeve, you can wager he'll be there again next autumn. Even without a confirming shed, it's worth at least an opening play.

♦ Ante up. In July, based upon post-season scouting, ease in and hang tree stands at the two locations most likely to grant a bow-range sighting of your deer in midautumn. One should be close to his supposed bedding area, and one should be near favored territory along his travel route. Place one stand so that it will be huntable on prevailing fall breezes—generally southerly—and the other in a favorable relationship to predictable autumn cold-front winds, mostly northerly. Unless your constitution revolts, shove your stands up 25 to 30 feet, preferably in oaks, which will hold cover leaves into mid-November.

During August, invest some time glassing nearby feeding sites at dusk. You may spy the old rascal. Watch for entry and exit paths, and slip another strategic stand or two up before bow season. Also, set them back in the woods a bit to better the chance of a shot before dark.

This is the equivalent of slipping a spare ace up your cuff, which in this game is not only legal, but laudable. Hunt your feeding route stands intensely the first five afternoons of bow season. Get in early, before the does start moving. Remember, Mr. Big Antlers is likely to be in the company of other bucks then, and likes to send them out first, so keep it together. You may get a crack at him. After the first several hunts, the opposing odds increase exponentially.

Aside from remote feeding-trail ventures, hold your primary play until your buck has established a renewed pattern of territorial dominance. Bucks begin territorial rubbing in the Piedmont in September, varying a week or so east and west, and have usually hacked out a reliable rubline by mid-October, with perhaps a few early scrapes.

In early to mid-October, go in before daybreak to avoid detection, and slip into one of your tree stands. You might win the equivalent of the Florida sweepstakes and catch him heading home at first light.

After the deer activity dies, maybe 10:30 a.m., ease down and scout. Wear rubber boots, move quietly and efficiently, and leave as little scent as possible. Check the nearby rub and immediate vicinity for renewed torment, then sneak along last fall's travel route, searching for his signature. If the pre-feeding staging area for the primary concentration of does in your area has changed since last season, also scout the logical route from there back to his bedding cover. But be out of the area by 2 p.m.

If there hasn't been a major upheaval in habitat or human presence, you'll likely find what you're looking for.

A few days later, slide back in around lunch and put up one or two additional stands close to fresh sign.

♥ **High card bets.** Shun your targeted territory until the odds turn your way. Experts widely agree that the best time to take a trophy buck is during the frenzied stages of the prerut, and that chances for a random buck are best when the rut is at its peak. A buck that's pattern-reliable during prerut grows fickle as the craze of the full rut drives him relentlessly in pursuit of hot does.

In North Carolina, the prerut frenzy coincides with the last six days of bow season and muzzleloading week. This is prime time! Your target buck will still be largely pattern-reliable and prone to move during daylight hours. Throw your best card. Hunt hard and wise, morning and afternoon, alternating stand sites.

♠ **As long as the game's alive.** Discipline yourself to extended hours on morning hunts, and arrive in time for afternoon sits. When the prerut is boiling, your buck may move at any hour of the day. A quick poll of seven hunting acquaintances who frequently beat the odds on trophy bucks suggests 11:30 a.m. as the earliest advisable departure time for morning hunts, and 3 p.m. as the latest advisable entry time for afternoon stints. My personal log certainly corroborates this. If I had left my morning stands at 9:30 a.m. during the past five seasons, I would have missed almost half of my biggest deer!

Stay focused. Three seasons ago, I hunted a patterned super-buck eight times in 12 days during the prerut. When he hoofed a tremendous scrape 30 yards from my perch, the encounter seemed imminent. No dice. I heard him trail by in the dark on three occasions, but come daylight, he was scarce venison. I was in a virtual stupor of despair, when finally on Halloween morning at 9:49, he sauntered religiously up his rubline and halted broadside in a logging trail, affording a 30-yard shot. If he hadn't surprised me so utterly, I would have made it.

A year later, I set up on another bruiser, and he arrived at 10:30 the very first morning, coming from his bedding area rather than going back. My attention was glued to the opposite end of the trail, and he was under me before I realized it. He surprised me, too, but not quite enough.

♣ **Knowing when to call.** Many hunters allow big bucks to intimidate them into failure by succumbing to target panic and rushing the shot. Hold yourself to a quick reality check before you commit. Pick a vital spot on the animal as an aiming point, and wait until it is optimally and ethically presented. Cool play is absolutely essential if you hope to clean the table. Make your moves while your rival is temporarily distracted, never when he's alert and in your face. Often, you can stop a walking or trotting buck by softly grunting.

If it feels wrong, don't chance it! When the prevailing breeze will place you squarely upwind of where you expect him to walk, and you don't have an alternate stand that works, trash your hand and sleep in. Be especially cautious when the weather station reports "calm" winds. Light winds are almost always directional. Don't get drawn into a fool's game. It takes only a sliver of scent to about-face a wary buck. Use a small puff bottle filled with corn starch to detect the actual flow of the current.

Similarly, tepid air and high-humidity, such as you get on overly warm, foggy mornings after overnight showers, holds ground and air scent like a thirsty sponge.

♦ **When he calls your bluff.** Sometimes it's an exacting prime-time snort that keeps you from lying to yourself that it's not really you he smelled. Occasionally, it's a glimpse of a skirting shadow. Either way, it means he has your number. It's time to close it down. Joker's wild. Do something unexpected.

After one savvy buck sneaked wide of his stand the second time, a Randolph County friend fooled him into folly by beating him at his own game. First, he left his cap and jacket in his original stand, waited two days, then slipped in downwind of the buck's evasive detour and set up a climbing stand. Just before dusk, the heavy eight-pointer tipped through, with riveted nape and nostril locked onto the bogus hunter. A well-placed arrow sealed the deal.

♥ **When he changes the game mid-deal.** Your deer may alter the house rules anytime. When you hunt during prime time, do a little impromptu scouting as you sneak out. Use your binoculars to minimize scent dispersion, keeping your distance from rubs and scrapes. If your existing strategy doesn't match his minute-by-minute game plan, retool immediately.

Three years ago, after locating a stand on a summer post-season scouting prospectus, I was delighted when my buck opened signature rubs along the same trail in October. I heard him go by predawn the first morning, but two more sits passed without reward. I normally sneak in and out of a hot stand site as directly and quickly as I can. But I could sense something awry. When I climbed down, some impromptu scouting revealed a new rubline, smoking fresh and 60 yards south as well as a scrape the size of a '55 Buick. I relocated my stand the same morning, returned 48 hours later and got the shot at 8:20.

If you hunt a promising stand three sits straight and all it turns is a few squirrels and a barred owl, change scenery. It's a good rule that pays more than it fails.

Check the sign. Try your next-best stand. Alternate between two or three on consecutive days. Don't let your opponent pattern you.

♠ **When the chips are down.** If you haven't glimpsed a whisker of your opponent, and you suddenly realize you've hunted mornings only for three days, switch to afternoons for a spell. Particularly on full moons, bucks tend to move more during afternoon hours. If you've approached your stand by sneaking down the ridge two days straight, sneak quietly along the center of the creek on the third. Always use a route that minimizes and strategizes ground scent. Cross your target trail only once and at spots that afford a shot as or before your buck reaches it.

If a party of does casts their eternal stare until sweat beads your brow and your bladder tags out, and finally they blow, hang it up. It's over, and you might as well take your stand down. Try falling back to an alternate site or put up another stand a comfortable distance away on the downwind side. Using the old stand as a diversion, you can plot Cleopatra against Caesar.

♣ **When the house is too full.** Constant harassment can skitter even the most amorous mossy-antlers. Any heat at all, and he's out of the kitchen, becoming nocturnal or completely vacating the area. Disruption sometimes results from transgressing hunters but most commonly occurs with canine interference.

Last season, I hunted extremely promising sign during the entire prerut period. I practically drooled to lay eyes on the monster that so pitilessly annihilated a cedar the size of a truck axle. I never saw him, though my timing was precise and I shifted my efforts creatively across his territory. Every day that I hunted, the same two mongrels coursed through on the heels of a doe. I worried, but stubbornly stayed with the game.

I'm convinced now that my buck had fled his core area because of the incessant hounding before things had a chance to get serious. I wasted a lot of blue-chip hours on an empty table.

When the disturbance is that constant, whatever the source, find another game.

♦ **Luck of the draw.** No system ever beat Vegas for long—it's how the cards fall. That's what makes trophy whitetail hunting the incomparable game of chance that it is. And it's why so many of us remain addicted, forever looking for an edge.

Seven come eleven! ⚄

Raleigh cartoonist Jackie Pittman was awarded the National Cartoonists Society's 1999 Reuben Award for Best in Advertising & Illustration. This is the second time he has won the award.

Have you ever planted vegetable seeds in a garden, but grown dandelions instead? Even after you pull every weed, more always grow. Who plants these uninvited guests? How did their seeds get there?

Seeds on the Move

written by Buffy Silverman / illustrated by Consie Powell

WHAT IS A SEED?

Seeds come in all shapes and sizes. They can be fat, skinny, smooth, wrinkled, round or triangular. Some are as big as a football. Others are as tiny as a grain of sand. But all seeds have the same basic parts.

Seeds begin inside flowers. When **pollen** from one flower lands on another flower of the same kind of plant, it grows down and joins an **ovule**. The fertilized ovule grows into a **seed**, surrounded by a **fruit**.

dandelion

On the outside of a seed is a **seed coat** that protects the seed, and keeps it from soaking up water and sprouting in the wrong season. Inside the seed is an **embryo**, the tiny baby plant. Until the baby plant grows green leaves that can make food, it needs stored food for energy. This food is packaged in one or two seed leaves, called **cotyledons** and in starchy material called **endosperm**.

After a flower's petals fade, leaving a ripe fruit with seeds inside, a new plant can begin its life. Many seeds will not sprout immediately, even if given moisture and warmth. These seeds are **dormant** and need a period of cold before they grow. Some must dry out before they sprout. Others must have their seed coats worn off by rubbing against soil or going through an animal's digestive tract.

If seeds fall directly off a parent plant and land in the soil beneath it, chances are good that not very many of them will grow—there is too much competition for moisture and sunshine. So seeds have many tricks to help them travel away from the parent plant.

red maple

milkweed

How long can a seed stay dormant and still sprout? Scientists found frozen arctic wildflower seeds that were about 10,000 years old. Given moisture and warmth, the seeds sprouted in 48 hours!

BLOWING IN THE BREEZE

Many trees rely on the wind to carry their seeds. A maple tree's wing-shaped fruits spin around and around like a helicopter. A basswood's fruits are attached to a special leaf that sails through the air like a glider.

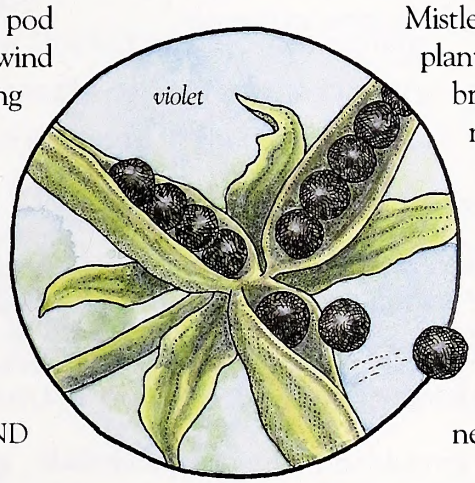
The wind also scatters seeds of smaller plants. The stem of a dandelion blowball towers above the yellow flowers to catch a breeze. A silky parachute sits atop each brown dandelion fruit. When the wind blows, the tiny parachutes carry fruits away. Little barbs on a fruit help it burrow when it lands so the seed inside reaches the soil.

Milkweed seeds also have parachutes attached to them. Only a few milkweed flowers on a plant grow into fruits, called pods. But each pod has hundreds of seeds packed inside. When a pod ripens, it points up toward the wind and splits along one side. Blowing breezes catch the parachutes, pulling seeds out of the pod.

SHOOTING SEEDS

Some plants' fruits work like sling shots—they fling their seeds away. A ripe violet splits open in three canoe-shaped sections. As the sides of each section dry, the walls shrink, squeezing the seeds until they pop out, one by one.

Mistletoe seeds are the speed demons of the plant world. Mistletoe grows high on the branches of forest trees. When its fruits ripen, water pressure builds up inside until the fruits burst, shooting seeds as far as 50 feet at a speed of 60 miles an hour. The sticky seeds land on branches of nearby trees. Some stick to birds' feet and feathers, and are carried to new trees.

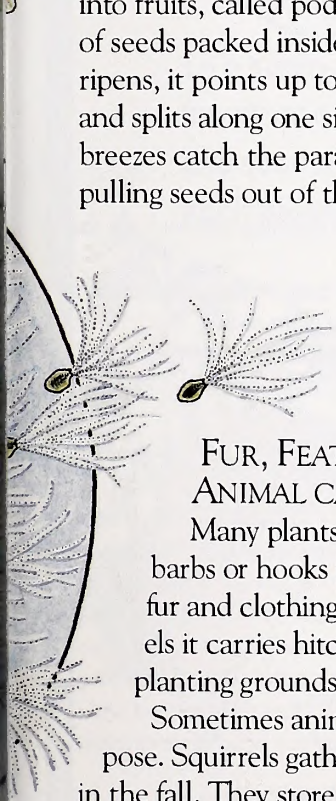


FUR, FEATHERS AND ANIMAL CARRIERS

Many plants have fruits with hairs, barbs or hooks that cling to feathers, fur and clothing. When an animal travels it carries hitchhiking seeds to new planting grounds.

Sometimes animals carry seeds on purpose. Squirrels gather acorns and other nuts in the fall. They store their nuts for winter food by burying them. If they forget to dig up a nut, a tree sprouts.

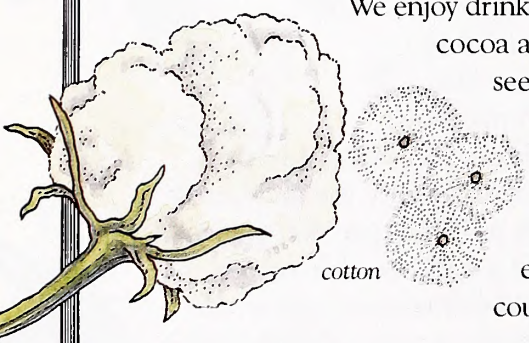
When a bird eats a bright-colored fruit like a cherry, it drops the seed or swallows it. Since the bird cannot digest a cherry seed, the seed comes out in the bird's droppings, ready to sprout and surrounded by fertilizer.



PEOPLE AND SEEDS

People have carried seeds from place to place for thousands of years. Many weeds that now brighten our roadsides came from other lands as seeds hitching a ride on the cargo or animals in settlers' ships. Other seeds were brought by settlers to plant for food.

Every day we depend on seeds. Wheat, corn and rice seeds feed people around the world. Nutmeg, cumin, coriander, dill and other spices from seeds flavor our meals. We enjoy drinks made from seeds—coffee, cocoa and cola. We even wear seeds—cotton socks, shirts and underwear are made from the fibers that surround cotton seeds. Without seeds, most of the plants on earth could not grow, and people could not survive.



cotton

What Does It Mean?

pollen: a tiny grain, the male part of a flower, that can fertilize an egg
ovule: the egg or female part of a flower
seed: the structure, formed when an ovule is fertilized by pollen, that can grow into a new plant
fruit: a ripened ovary (of a flower) containing seeds
seed coat: the outer layer of a seed
embryo: a young plant in a seed that has not yet germinated
cotyledons: seed leaves with stored food
endosperm: tissue containing stored food
dormancy: a time in which a seed will not grow without special cues, like cold exposure

Read and Find Out

- *From Flower to Fruit* by Anne Ophelia Dowden, Thomas Y. Crowell, 1984.
- *How Seeds Travel* by Cynthia Overbeck, Lerner Publications, 1982.
- *How Plants Travel* by Joan Elma Rahn, Atheneum, 1973.
- *The Magic School Bus Plants Seeds* by Patricia Relf, Scholastic, 1995.
- *SEEDS Pop, Stick, Glide* by Patricia Lauber, Crown Publishers, 1981.
- *Seeds and Seedlings* by Elaine Pasco, Blackbirch Press, 1997.
- *Faith in a Seed: The Dispersion of Seeds* by Henry D. Thoreau, Island Press, 1993.

In *Wildlife in North Carolina:*

- "Seed Time" by Lawrence S. Earley, October 1989.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

Seed Need: teaches students how wildlife contributes to ecological systems by dispersing plant seeds.

Wild Edible Plants: teaches students to identify native edible plants and to understand the relationship between wild and cultivated plants.

Get Outside

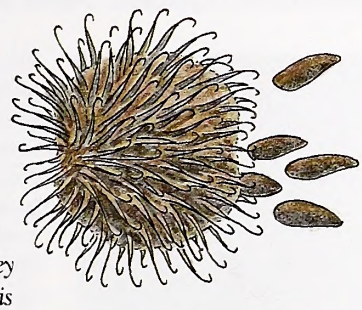
Autumn is an excellent time to find seeds. Pull off seeds that stick to your pants, socks and shoelaces when you go for a hike in the woods or fields. Look at your seeds with a hand lens or magnifying glass and decide what makes them stick. Collect other kinds of seeds that travel in different ways.

Find some winged fruits from maple, ash or elm trees. Take the wings off half the fruits. Toss your winged and unwinged fruits up in the air and see which gets carried farthest by the wind.

Collect some mud from the side of a pond and put it in a pot. Put the pot in a warm place, and keep the soil damp. How many plants sprout from the seeds buried in the mud? Charles Darwin tried this experiment with three tablespoons of mud, and 537 plants sprouted. Can you beat that?

Editing and design by Consie Powell. Art puzzle by Anne Marshall Runyon.

George de Mestral was hiking with his dog in Switzerland in 1948. When he came home, he noticed burdock fruits stuck to his pants and clinging to his dog's fur. He carefully examined the hooks on the burdock fruits and saw that they clung to loops in the fabric of his pants. Then he decided to make a fastener with similar stiff hooks and tiny loops. You might use his invention—Velcro—to fasten your sneakers or coat.



Get WILD

Advanced WILD Workshops:

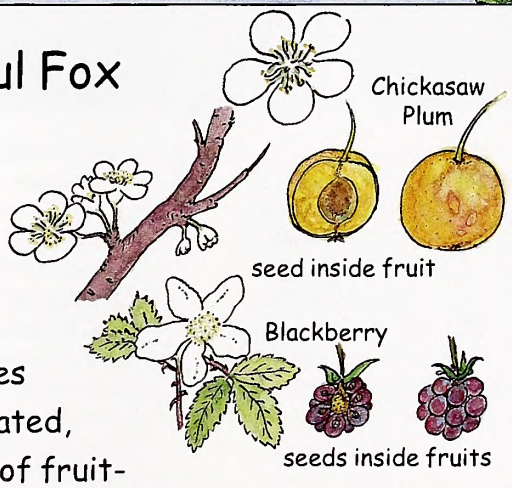
Oct. 15-16 – *Predators and Prey*, Morrow Mountain State Park, Albemarle. Call Mel Porter, (704) 982-1523.

State Conference:

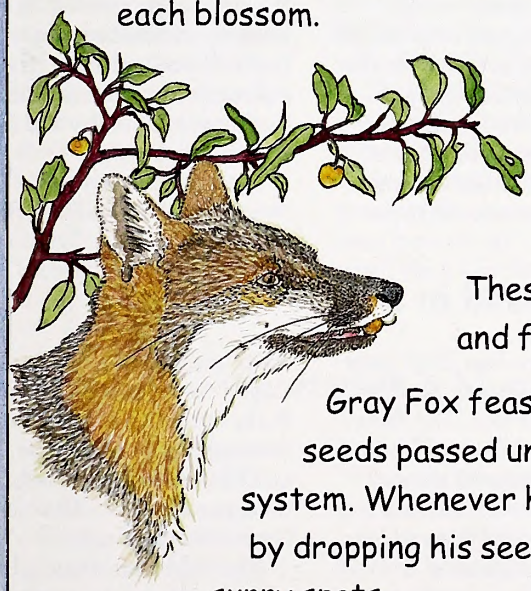
Nov. 9-11 – North Carolina Science Teachers Association (NCSTA) Conference, Greensboro. Division of Conservation Education will present N.C. CATCH workshop and concurrent sessions about wildlife species and fisheries. Visit Division's exhibit. For conference registration, call NCSTA (704) 642-1495.

The Smart Seeds and the Fruitful Fox

In a sunny field, the thicket of Chickasaw plums burst into bloom. Insects pollinated the flowers and soon a tiny seed wrapped in fruit replaced each blossom.



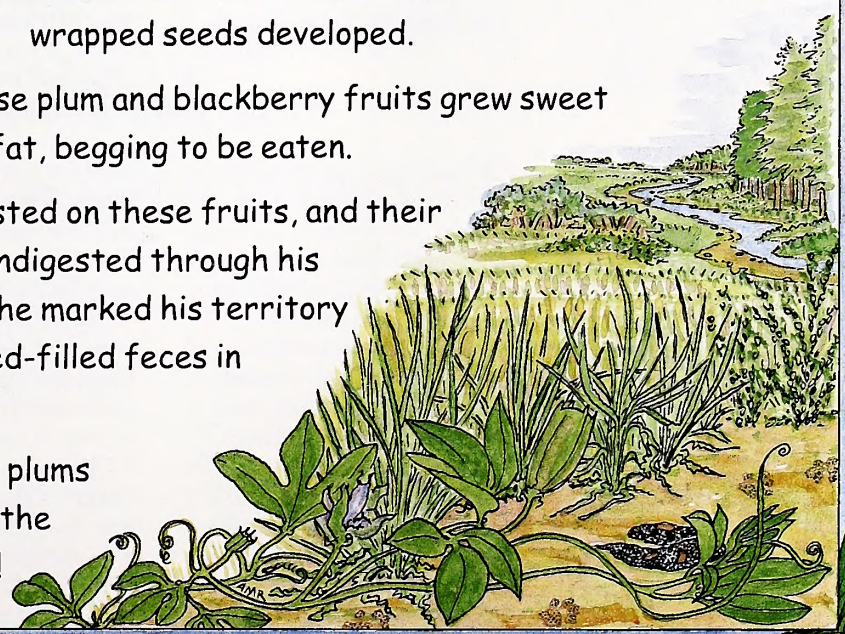
Then the blackberries bloomed, were pollinated, and small clusters of fruit-wrapped seeds developed.



These plum and blackberry fruits grew sweet and fat, begging to be eaten.

Gray Fox feasted on these fruits, and their seeds passed undigested through his system. Whenever he marked his territory by dropping his seed-filled feces in sunny spots...

Little Gray Fox planted new plums and blackberries to grow in the clearings they like the best!



North Carolina Wildlife Resources Commission Under New Leadership

MELISSA McGAW

A new chairman, *vice-chairman and three commissioners were recently instated to the N.C. Wildlife Resources Commission. From left are: former Wildlife Commission Chairman Jim Bennett; commissioners Bobby Purcell, Troy T. Boyd Sr. and Charles Bennett; Vice Chairman Wes Seegars and Chairman John E. Pechmann.*

Following unanimous votes, two commissioners were recently chosen to fill the chairman and vice chairman slots on the N.C. Wildlife Resources Commission.

John E. Pechmann, of Fayetteville, was elected chairman, and Wes Seegars, of Goldsboro, was elected vice chairman.

Upon accepting the symbolic gavel, Pechmann said that during his chairmanship he would like to see the Wildlife Commission upgrade fish hatcheries, promote quail populations and construct a new educational center in Currituck County.

"We do, indeed, have as fine an agency as there is in the state of North Carolina and—I personally feel—in the country," said Pechmann, while addressing the Wildlife Commission. "That's due to all of the hard work you do, and it is certainly due to the fact that we have a staff of over 500 that—to the man and the woman—is the finest wildlife staff in the country."

Pechmann replaces Jim Bennett, who recently completed a two-year term as chairman. Bennett, a Greensboro resident, will remain a wildlife commissioner, representing District 5.

"It's been a labor of love," said Bennett. "I have always wanted to serve on the Wildlife Commission and have the privilege of serving as chairman. It has helped me grow, and it is something I have really enjoyed doing."

In addition, the following members were recently appointed to serve two-year terms at large on the Commission: Charles Bennett, of Matthews; Troy T. Boyd Sr., of Elizabeth City; and Bobby Purcell, of Cary. They replace former commissioners Joe Long, John Coley and Charles Preston.

—Chris Powell

Edited by Chris Powell

Game Land to Expand in Pender County

The Cape Fear River Wetlands Game Land will grow by more than 1,000 acres, as a result of a recent purchase made by the N.C. Wildlife Resources Commission.

The 1,143-acre Bellhammon tract, located adjacent to the game land along the Northeast Cape Fear River, was purchased from International Paper Realty Co. The transaction was made possible through a $868,415 grant from the state's Clean Water Management Trust Fund, said Wib Owen, section manager for the Commission's Division of Wildlife Management.

"We saw this as a way to expand the Cape Fear River game land, so we pursued the deal with assistance from The Nature Conservancy," Owen said. "It's good land with good access."

As part of the Northeast Cape Fear River Wetlands Game Land, the Bellhammon Tract will be open to the public for recreation and hunting. The Bellhammon tract is a critical section of the Northeast Cape Fear River floodplain natural area, considered nationally significant by the N.C. Natural Heritage Program.

"In addition to protecting critical habitat for plants and wildlife, conservation of this land will help preserve the water quality of the Northeast Cape Fear River and will benefit the overall quality of life in this rapidly growing region," said Hervey McIver, protection specialist with The Nature Conservancy.

The American alligator, listed as threatened, lives in river habitat within the Bellhammon property, as well as the myotis bat, a species of federal concern. In addition, botanists have found three rare plant species on the property: savanna milkweed, southern bog button and spoonflower.

—Courtesy of The Nature Conservancy

Waterfowl Stamp No Longer Required

Hunters who purchase sportsman or comprehensive hunting licenses will not be required to purchase a state waterfowl stamp for the 1999-2000 hunting season.

Instead, the waterfowl hunting privilege has been added to the following three licenses: annual sportsman, annual comprehensive hunt and lifetime comprehensive hunt. (The lifetime sportsman license has always included the waterfowl-hunting privilege.)

"The decision to eliminate the state waterfowl stamp and automatically include the waterfowl privilege in the comprehensive hunting licenses was made to prevent confusion among license purchasers," said Richard Hamilton, assistant director of the N.C. Wildlife Resources Commission. "People were purchasing our comprehensive licenses and discovering later that they also had to purchase a waterfowl stamp. So, we've just added the privilege directly to those licenses."

Though the price of the three modified hunting licenses will not reflect the change this year, each will increase by $10 for the 2000-01 season. The increase should raise about $125,000 per year, which will be used for waterfowl management programs, Hamilton said.

N.C. WILDLIFE RESOURCES COMMISSION

***Sportsman and comprehensive** hunting licenses will include the waterfowl hunting privilege for the 1999-2000 season.*

The federal waterfowl stamp is still required and can be purchased for $15 at post offices.

Also, before applying for a swan permit next year, a person must have already purchased a valid North Carolina hunting license that includes the waterfowl hunting privilege.

"This requirement should discourage anti-hunters from buying swan permits only to prevent valid hunters from obtaining one of these limited permits to take a swan," Hamilton said.

The cost for obtaining a swan permit next season will be raised from $5 to $10.

—Chris Powell

Roadside Ceremony Defended

Dear Wildlife:

After reading the "On Patrol" section of your July issue, I was distressed that you would consider the woman chanting over the deer to be humorous or bizarre. I do not think we should make fun of other people's cultures and religions if they differ from ours. I do not know if this woman was Native American, but her love and concern for the deer is typical of their beliefs.

Dana Sims,
Alamance County

Editor's note: *The above letter was one of two we received, regarding the "On Patrol" column in the July 1999 issue. The piece, in no way, was intended to poke fun. The column's purpose, as always, was to illustrate the varied situations wildlife officers continually face. Sometimes these encounters are humorous, other times they are simply out of the ordinary.*

Sportsman's Memory Lives on Through Wildlife Fund

Almost $6,000 was recently donated to the N.C. Wildlife Resources Commission's Wildlife Endowment Fund in memory of Michael J. Leslie Jr., who died a year ago in a traffic accident.

Leslie, a 23-year-old senior at North Carolina State University, was a lifetime sportsman license holder and spent much of his youth hunting, fishing and appreciating nature, said Karen Leslie-Ragan, his mother.

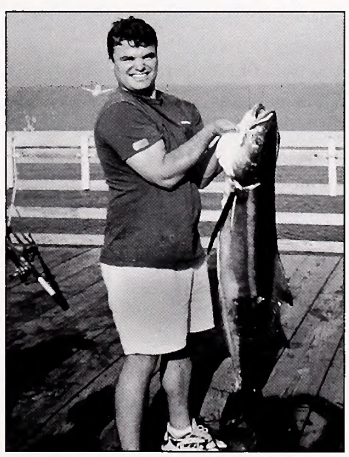
"He learned how to fish at the pond behind my father's house," Leslie-Ragan said. "He could fish before he could walk. He also liked to saltwater fish, and he would go on a lot of duck hunting trips with his father, M.J. Leslie Sr."

In recognition of the contributions, the Wildlife Commission will place a plaque honoring Leslie's memory at the Pisgah Center for Wildlife Education.

Monetary donations in memory and honor of wildlife enthusiasts are placed into the Wildlife Endowment Fund along with proceeds from the sale of lifetime licenses and lifetime subscriptions to *Wildlife in North Carolina*. But only the fund's accumulated interest is spent. The principal remains forever invested to generate additional revenue for future wildlife conservation.

Tax-deductible contributions may be sent to the Wildlife Endowment Fund, care of the N.C. Wildlife Resources Commission, 1712 Mail Service Center, Raleigh, N.C. 27699-1712.

—Chris Powell



Michael J. Leslie Jr., 1998

Bear Season Extended

Bear hunters received a double dose of good news recently, when the N.C. Wildlife Resources Commission extended the bear season for the Northeast section of the state, and increased bear-hunting territory in the Mountain region.

For the 1999-00 hunting season, nine additional hunting days have been added to the Northeastern season, which includes Beaufort, Bertie, Camden, Craven, Dare, Gates, Hyde, Jones, Pamlico, Pasquotank, Tyrell and Washington counties. The extra days have also been added to the portion of Chowan north of a line formed by S.R. 1002, S.R. 1222 and S.R.1220, including Currituck but excluding Knotts Island and the Outer Banks. Hunting dates for the above counties will be Nov. 8-13 and Dec. 13-25.

Other black bear season dates are Nov. 8-13 and Dec. 13-15 in Hertford and parts of Northampton, Halifax and Martin counties. (For specific information, see the *1999-00 Regulations Digest*.) In the southeastern counties, bear hunting will be allowed Nov. 8-Jan. 1, and Dec. 13-Jan. 1 in Brunswick and Columbus counties.

In addition, the Wildlife Commission agreed to expand the Mountain region bear-hunting territory by moving the boundary eastward. The new line is N.C. 113 from the Virginia state line to N.C. 18 and then N.C. 18 to the South Carolina line.

—Bodie McDowell

Field Notes

Eastern Gun Deer	Oct. 18-Jan. 1
Eastern Bow and Arrow Deer	Through Oct. 9
Central Bow and Arrow Deer	Through Nov. 6
Northwestern Bow and Arrow Deer	Through Nov. 13
Western Bow and Arrow Deer	Oct. 18-Nov. 20
Eastern Muzzleloading Deer	Oct. 11-Oct. 16
Western Muzzleloading Deer	Oct. 11-Oct. 16
Central Muzzleloading Deer	Nov. 8-Nov. 13
Black Bear	See *Regulations Digest*
Wild Boar	Oct. 18-Nov. 20
Gray Squirrel	Oct. 18-Jan. 31
Fox Squirrel	Oct. 18-Dec. 31 (Only in 20 counties; See *Regulations Digest*)
Fox	See *Regulations Digest*
Raccoon and Opossum	Oct. 18 (sunrise)-Feb. 29
Ruffed Grouse	Oct. 18-Feb. 29
Mourning Doves (first season)	Through Oct. 9
Rails, Gallinules and Moorhens	Through Nov. 12
Crow	Through Feb. 29 (Thursday, Friday and Saturday)
Bobcat	Oct. 18-Feb. 29

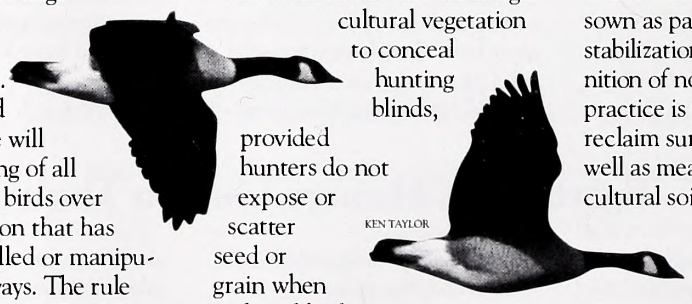
Migratory waterfowl regulations unavailable at press time. For waterfowl seasons and limits, call 1-800-675-0263 after Labor Day. Information on bag limits, either-sex deer season and other regulations may be found in the *1999-2000 North Carolina Inland Fishing, Hunting & Trapping Regulations Digest*. For a copy, check with license agents or contact the N.C. Wildlife Resources Commission at (919) 662-4370.

Changes in Baiting Regulations Support Wetlands Management

The U.S. Fish and Wildlife Service announced that it is revising regulations governing the baiting of migratory game birds for the first time in 25 years.

The Fish and Wildlife Service will allow the hunting of all migratory game birds over natural vegetation that has been mowed, tilled or manipulated in other ways. The rule gives landowners the flexibility to manage and hunt wetland habitat without fear of violating federal regulations that prohibit hunting over areas where seed or other feed has been exposed or scattered.

The new rule seeks to eliminate past public confusion about the types of activities considered to be baiting. Hunters will now have assurance that they will not hunt illegally if they inadvertently scatter seed from standing or flooded crops when entering or leaving a hunting area, placing decoys or retrieving downed birds. The rule also allows the use of natural or agricultural vegetation to conceal hunting blinds, provided hunters do not expose or scatter seed or grain when making blinds in agricultural fields.


KEN TAYLOR

On agricultural lands, the rule establishes a distinction between land management practices allowable for the hunting of all migratory game birds and those practices allowed for hunting birds such as doves and pigeons but not permitted waterfowl, cranes and coots. The rule provides definitions for these different land management practices.

The new rule also continues to allow hunting over top-sown seeds that are present as a result of a normal agricultural planting. In addition, it authorizes hunting over seeds top-sown as part of a normal soil stabilization practice. The definition of normal soil-stabilization practice is plantings intended to reclaim surface-mined lands as well as measures to control agricultural soil erosion.

Loss of habitat is the leading threat to the nation's migratory birds. More than half the original wetlands in the United States have been lost, and biologists classify many remaining wetlands as degraded.

"Wetland conservation on private lands is essential to the long-term survival and growth of waterfowl and other migratory bird populations in North America," said Jamie Rappaport Clark, director of the Fish and Wildlife Service.

—Courtesy of the U.S. Fish and Wildlife Service

Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

Oct. 10-16

National Wildlife Refuge Week will be celebrated across the country. Nature walks, birding tours, special hunts and environmental education programs are planned. For more information about events scheduled at North Carolina's 11 national wildlife refuges, contact the nearest refuge office or call (800) 344-WILD. Web address: http://refuges.fws.gov/

Oct. 23

The Pisgah Center for Wildlife Education, located near Brevard, will conduct the program "Turtle Talks" from 2 to 3:30 p.m. This program uses live turtles, snakes and lizards for an entertaining and educational discussion. For more information, call (828) 877-4423.

Oct. 29-30

The Pollocksville Rotary Club will sponsor the 7th annual Big Game Hunting Tournament at the Pollocksville Town Park and Boat Landing. The entry fee is $30 and must be received prior to Oct. 21. Entry forms are available by writing: Pollocksville Rotary Club, P.O. Box 1000, Pollocksville, N.C. 28573; or fax (252) 636-0443. For more information, call Bob Davis at (252) 224-0152. All tournament proceeds will be used for community projects and to support N.C. Hunters for the Hungry Inc.

Nov. 26-27

The Anson County Chamber of Commerce will sponsor a deer-hunting tournament. Participants must be registered by Nov. 19. To register, call the Chamber of Commerce at (704) 694-4181. The deer can be taken in Anson County or any adjacent counties.

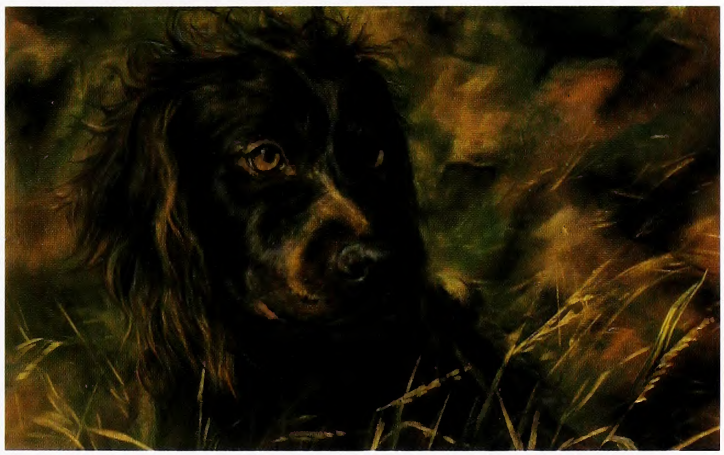
Outdoor Tips

Preventing Muzzleloader Misfires—A common problem with muzzleloaders is misfires. These often occur because the breech of the gun is clogged with residue, preventing the percussion cap's spark from reaching the powder at the base of the barrel. When this happens, the rammed bullet usually can only be removed with a special extractor—a tedious process. But there is a simple way to almost always avoid this situation. With the muzzleloader unloaded, place a wad of paper in the end of the barrel, but don't ram it. Next, put a percussion cap on the gun's nipple and fire the unloaded weapon in a safe direction. If the force from the percussion cap blows the paper from the barrel, you'll know the breech is clear and the weapon can be loaded.

Vernon Powell,
Newport News, Va.

Editor's note: *Do you have a tip or suggestion you would like to share with our readers? If so, please write Chris Powell at 512 N. Salisbury St., Raleigh, N.C. 27604; Fax: (919) 715-2381; E-mail: (powell.chris@coned.wildlife.state.nc.us)*

The 2000 *North Carolina Wildlife Calendar* is Here!



"Always Ready: Boykin Spaniel" by Keith Hendrickson is one of 12 fine paintings featured in the 2000 North Carolina Wildlife Calendar. *Order now before they're sold out.*

The works of Robert C. Flowers Jr., Robert B. Dance, Dempsey Essick, Duane Raver, David Williams, Brian Edwards, Joe Seme, Tim Larson, Keith Hendrickson and Curwood Harrison are featured in the *2000 North Carolina Wildlife Calendar*.

Order yours today! Payment must accompany your order. Calendar orders may be charged to VISA or MasterCard, or enclose your check or money order (payable to NCWRC). Complete the form below and mail with payment to:

2000 Calendar, N.C. Wildlife Resources Commission
P.O. Box 29607, Raleigh, N.C. 27626-0607
(Office is located at 322 Chapanoke Road in Raleigh.)

GREAT CHRISTMAS GIFT!

Please send me _____ calendars at $6.00 each .....$_____

All N.C. residents add $.36 sales tax per calendar ..... _____

☐ Enclosed is my check for **total** payment of .....$_____

☐ Charge to MasterCard or VISA for the calendar(s) ordered above. My card number is _____ and the expiration date is _____/_____.

_____ (_____)_____
Card holder signature | Daytime Phone No.

If ordering 10 or more calendars, please provide your UPS deliverable address.

Name _____

Address _____

City/State/Zip _____

Phone (_____) _____

All orders must be prepaid. A $20 charge will be made on returned checks (NCGS 25-3-512). **For fund raising and bulk rate information (10 calendars or more), call (919) 662-4377. Please allow 4 weeks for delivery.**

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through July 1999

Principal Balance
$28,111,460.37

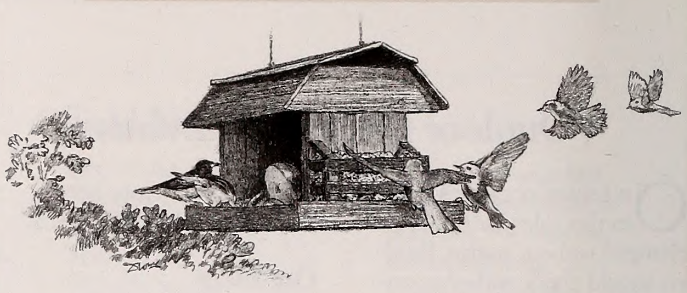
Interest Earned
$28,714,322.19

Total Receipts
$56,825,782.56

Interest Used
$17,275,819.04

Fund Balance
$39,549,963.52

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.



Backyard Birding Tips

by Rodney Foushee

Ah, the return of cooler weather and shorter days means fall has finally arrived. Before you get too relaxed, there's plenty to do to help our feathered friends through the coming months.

Cleaning Feeders: Now is the perfect time to thoroughly clean your bird feeders before the heavy winter feeding season begins. Scrub feeders with a solution of one part household bleach to nine parts warm water and allow them to air dry before refilling with fresh seed. To avoid spreading disease at your feeders, you should continue to clean and disinfect your feeders and birdbaths monthly with a bleach solution through the winter. It is also helpful to remove uneaten seed and bird droppings from under the feeders on a regular basis since these are the main sources of infection for birds.

Another good idea to prevent disease is to establish several feeding stations in your yard to avoid overcrowding and rotate feeders weekly to different locations. This will prevent a concentration of disease-carrying droppings and moldy seed, which in turn will lead to a healthier backyard bird population.

Choosing Bird Feed: When it comes to feeding wild birds, your best option is to buy high-quality seed mixtures. Though it is tempting to purchase bargain blends, these often contain old, inferior seed and are chock full of stems and other inert fillers. The best seed mixes contain large amounts of black oil sunflower seeds, which are considered the top wild bird food. Safflower seeds, white proso millet and cracked corn are also good ingredients. Avoid mixes that contain striped sunflower seeds—these large, cheap seeds are much harder for most birds to crack and contain a relatively small seed compared to black oil sunflower seeds.

Instead of purchasing premixed seed, you can mix your own and save money by buying the materials in bulk from a local feed or specialty store. A good mix includes 25 pounds of black oil sunflower seeds, 10 pounds of white proso millet and 10 pounds of cracked corn. Stir the ingredients together in a rodent-proof container such as a small metal garbage can, and be sure to store your seed mix in a dry, mold-free area.

As winter approaches, you can provide the birds with a high-energy food source by hanging out suet cakes. Though store-bought suet is fine, you can make your own by mixing either beef fat or peanut butter with corn meal or oatmeal. You can also add raisins or other dried fruit to the suet for variety.

N.C. WILD STORE

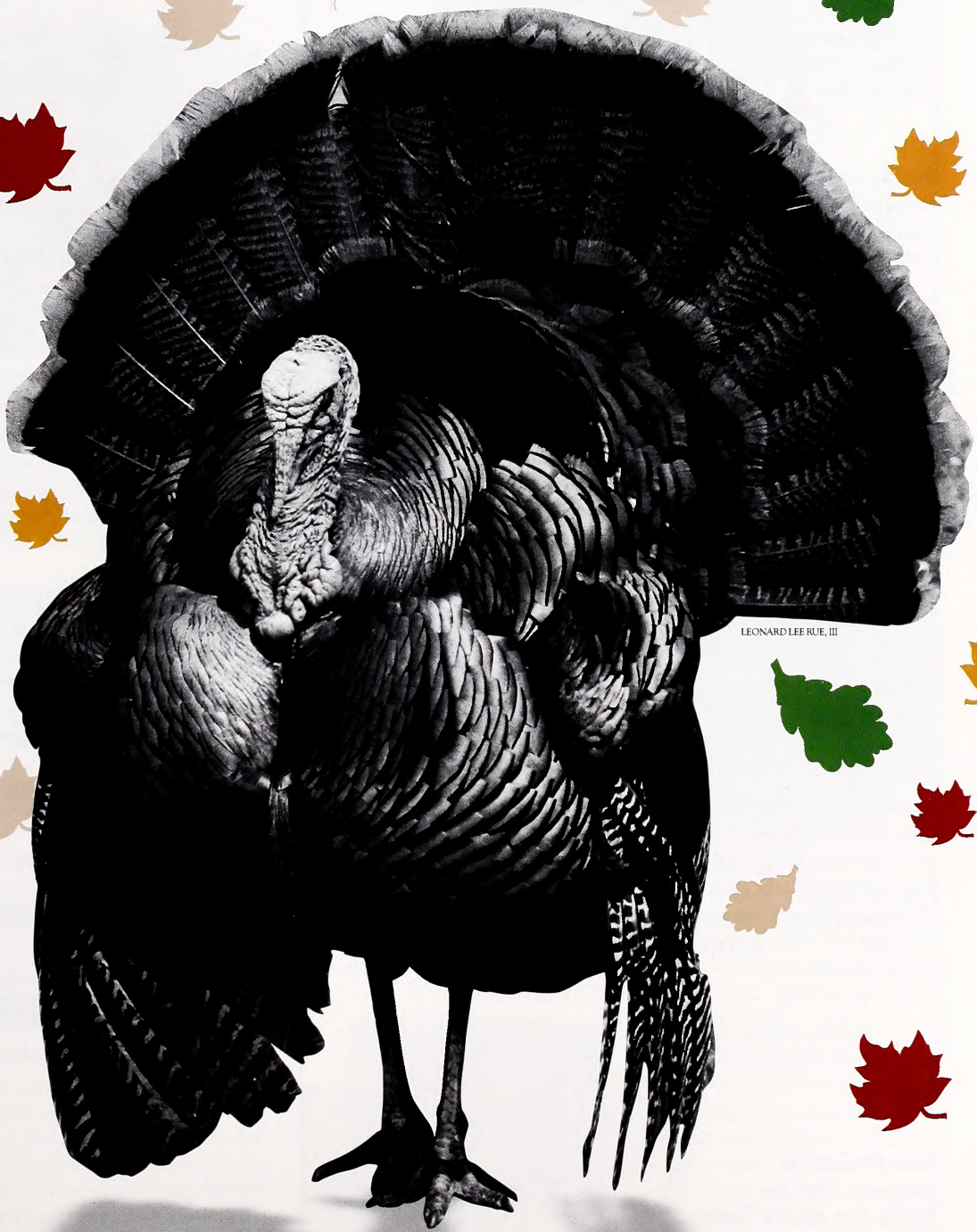
Holiday Pop Quiz:

If your "special someone" saw this photo, they would probably think of...

1. Checking to see what day turkey season opens in April.
2. Debating who gets the drumstick.
3. Rising before dawn and dressing in camouflage.
4. All of the above.

Chances are you've got an outdoor enthusiast to shop for. The State Fair, turkey shoots, and giving thanks are reminders that the holiday season is just around the corner.

Consider our great gift items for your special someone. Whether they fish, hunt or simply enjoy the outdoors, we have just what you need to finish your holiday shopping. We've even made it easy for you by selecting some of our most popular items. Just look for this symbol inside:



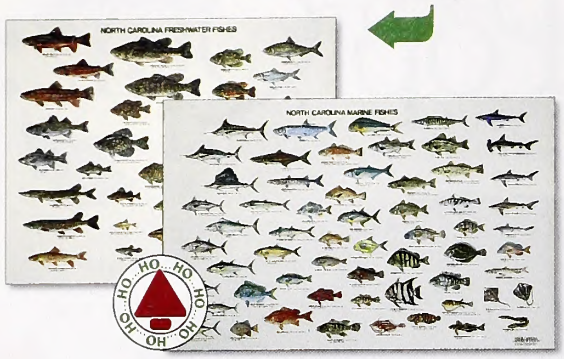
LEONARD LEE RUE, III

See page 40 for our new Wee Tees—T-shirts for kids! ☛

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

North Carolina's freshwater fish and marine fish are colorfully displayed on individual posters, and feature the art of Duane Raver. Reel yours in today!



Fishes of North Carolina

Set of 2. Freshwater fish poster shows 36 state species (size 28" x 22 1/2"). Marine fish poster shows 60 species (size 35" x 22 1/2") $10.

ITEM CODE **P9**

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50.

ITEM CODE **M9**

Also available as a boxed set. $30.

ITEM CODE **M10**

Before going on your next outdoor hike or camping trip, be sure you know North Carolina's reptiles.

Reptiles of North Carolina

Set of 4 posters in full color. Each poster decribes the species and denotes which reptiles are on the endangered, protected or special concern list. A set includes: lizards, turtles, and both live-bearing snakes and egg-laying snakes. Posters are sized 22" x 34". $18. ITEM CODE **P10**

Amphibians of North Carolina

The Hylid Frogs. North Carolina's tree frogs, cricket frogs and chorus frogs, belonging to the large family *Hylidae*, are presented in this colorful poster, one of two frog posters in the Amphibians series. 22" x 34". $6.

ITEM CODE **P11**

Amphibians of North Carolina

True Frogs and Toads. The second poster in the Amphibians series showcases true frogs and toads. Vibrant photos combine with informative text to make it a standout in the classroom or at home. 22" x 34". $6.

ITEM CODE **P14**

Waterfowl Decoys of N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.

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Sixteen traditional trout flies are presented in stunning color detail. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. Second in a series of "Sporting Heritage" posters. 22" x 34". $10. ITEM CODE **P13**

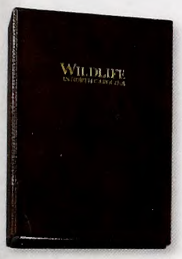
Bird Houses & Feeders: How to Build and Enjoy Them

An eight-page illustrated guide to building bird houses and feeders. $2.

ITEM CODE **M6**

Dogs that Point, Fish that Bite

Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. **$19.95.** ITEM CODE **M8**



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Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. $10.
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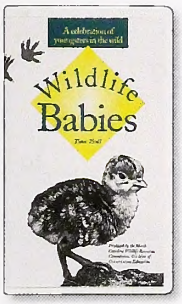

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Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others . $20.
ITEM CODE **N9**

Based on Chief Seattle's 1855 speech, the film's focus is on environmental ethics. Accompanied by This Land Is Sacred, this film is a must-see for everyone. It is destined to become a classic.

All Things Are Connected

Video and Activity Guide. $22.
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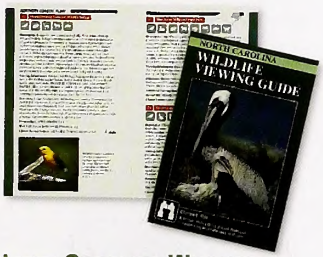


North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. **$5.95.** ITEM CODE **N6**

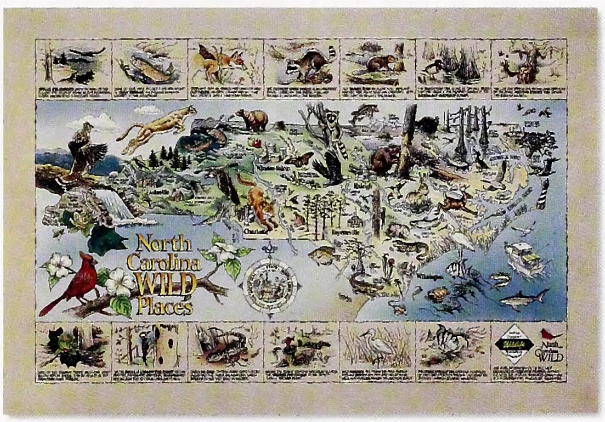
Gardens for Butterflies

Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. $2. ITEM CODE **M5**

Scouting Correlations

Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each $3.
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**

North Carolina's wildlife habitats come alive in this 82-page, easy-to-read, soft cover book. With delightful illustrations by Anne Marshall Runyon, N.C. WILD Places covers 13 habitats across the state.



North Carolina WILD Places: A Closer Look

Book and Posters Set. With each book you'll receive two habitat posters (also by Runyon) and a N.C. WILD Places Map poster, featuring the art of Jackie Pittman. $16. ITEM CODE **E6**

North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. $6.
ITEM CODE **E7**

More terrific items ☛

N.C. WILD STORE

Top-quality, 3-ring binder holds 120 WILDlife Profiles. Custom-made binder comes with a table of contents, tab dividers to organize Profiles by classes, an index and 120 fact sheets.

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Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass.

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster.

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat.

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad.

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish.

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet.

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet.

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.

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North Carolina WILD Cap. N.C. Wild cardinal on brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50. ITEM CODE **A1**

Wildlife in North Carolina Caps. Exclusive designs and magazine logo are featured on three different cap styles. $16.50 each.

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100% cotton natural color tee with design on back and Pisgah logo on front. $14.50.
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Just like the adult shirt with Pisgah design, only smaller.
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N.C. WILD T-shirt

N.C. WILD logo printed on front and colorful art on back. White. $14.50. ITEM CODES:
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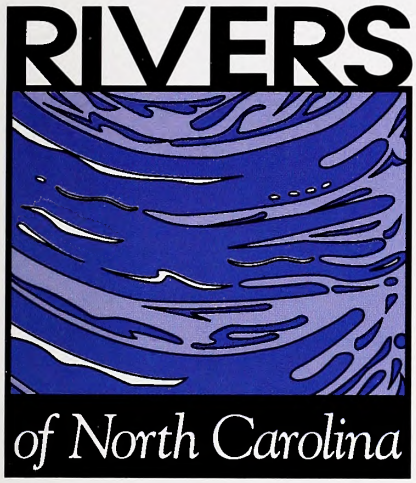
Coming Next Month...Our Special Issue on Rivers!



November's *Wildlife in North Carolina* will be an unprecedented 128-page special issue that celebrates the state's rivers and streams, and highlights their importance to fish and wildlife. Eighteen months in the making, "The Rivers of North Carolina" shows how ordinary citizens are taking the lead in restoring the health of our rivers.

Subscribers will receive "The Rivers of North Carolina" as their regular November issue. Additional copies may also be purchased for a limited time for $7.50 each (plus $3 for shipping and handling).

To order, or for more information about single or bulk purchases, contact Sherry Outlaw at (919) 733-7123, Ext. 265 or write to: "The Rivers of North Carolina," N.C. Wildlife Resources Commission, 1712 Mail Service Center, Raleigh, N.C. 27699-1712.

Entertainingly written articles profile each of the state's 17 river basins, investigate our neglected urban streams and assess the role of estuaries in coastal rivers.

Colorful maps pinpoint the boundaries of each river basin to help readers understand their ecological address.

Hitching a Ride

Plants employ surprising ways to spread their seed to new planting grounds, including hitchhiking in the fur of wildlife such as this raccoon. See N.C. WILD Notebook, page 28.

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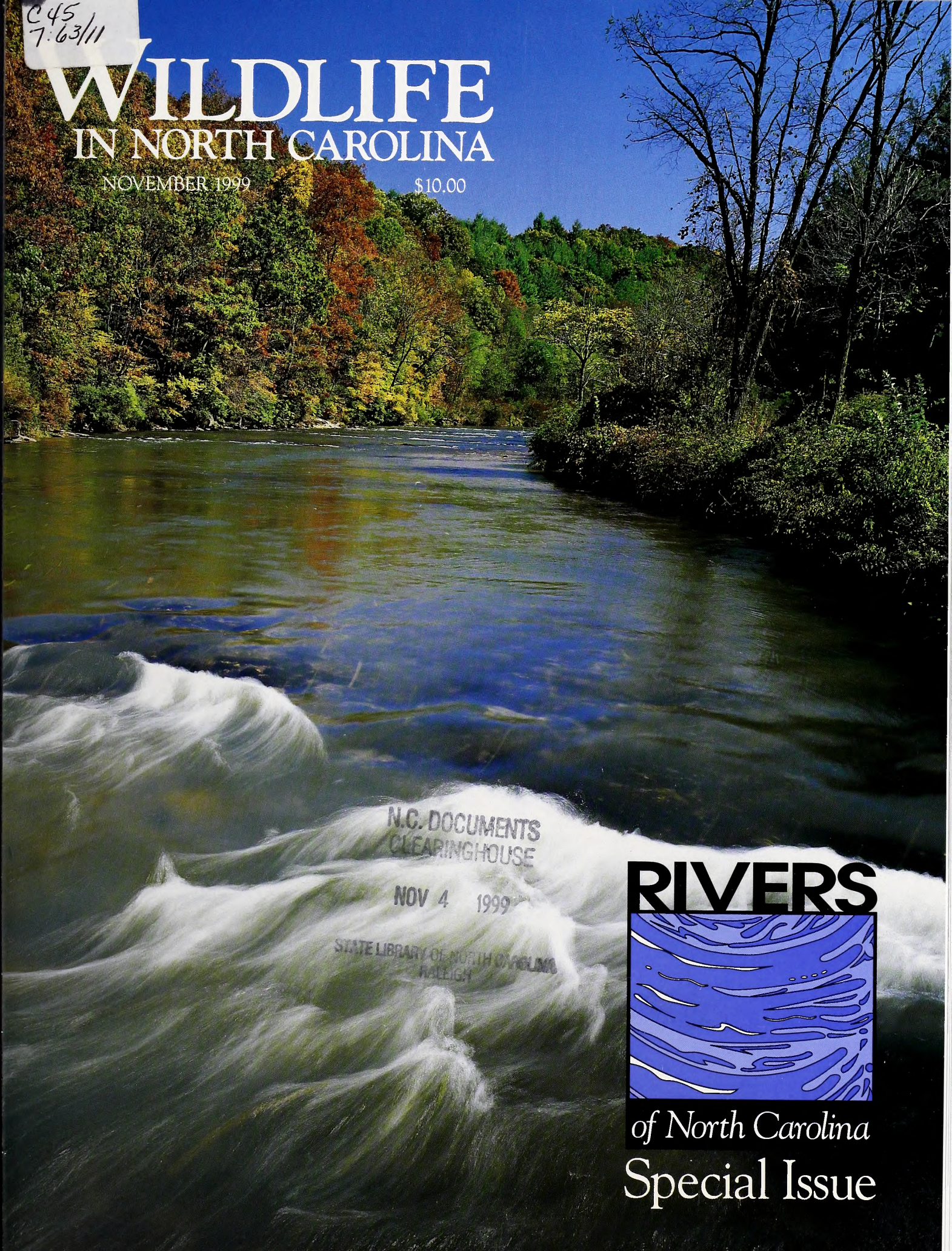

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Special Issue

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JAMES B. HUNT JR.
GOVERNOR

September 15, 1999

Dear Citizens of North Carolina:

"It's very hard for people to think regionally, but I think that environmentalists know that what is meant by ecology is interdependence, and a river is a singular example of that."

Margaret Nygard was onto something when she said this years ago in *Wildlife in North Carolina* magazine, and what she said then is true today. Margaret was a gentle but determined advocate for rivers in general, and for the Eno River in particular, and she would have delighted in this extraordinary special issue.

"The Rivers of North Carolina" is all about interdependence. It's about the deep and familiar ties that people have to their local creeks and rivers, in experiences that include everything from a springtime baptism to a first bluegill caught on a cricket. It's about the critical connections between upstream users and downstream users. It's about the way that rivers connect the mountains and the sea.

Rivers link us all in so many profound ways.

That's why I feel a deep pleasure in celebrating North Carolina's rivers in the coming year. The turn of the century provides an excellent opportunity to emphasize our interconnections as citizens of this state. We are all part of a greater entity. Each of us—every person, every community—is tied to a river basin that forms part of our ecological address.

As you read this issue of *Wildlife in North Carolina*, what will clearly emerge is the sheer capability and energy of our citizens as they work on behalf of their rivers. All across the state, in every river basin, citizens are joining together in creative ways. Volunteers have sponsored restoration projects, clean-ups and festivals. On a number of rivers and streams, alert monitors identify and report problems to state agencies and keep people informed. Our state and federal agencies are providing technical support, and critical financial help is coming from the Clean Water Management Trust Fund.

I hope "The Year of the Rivers" will help us all celebrate these successes and celebrate as well the manifold ways that rivers connect us to each other. I commend the N.C. Wildlife Resources Commission for publishing this special issue of *Wildlife in North Carolina*. I expect that it will provide the educational foundation for a year of reflection, celebration and action.

My warmest personal regards.

Sincerely,

James B. Hunt Jr.

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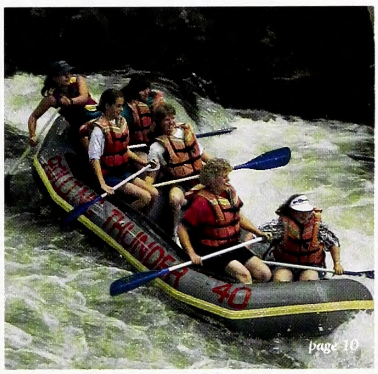

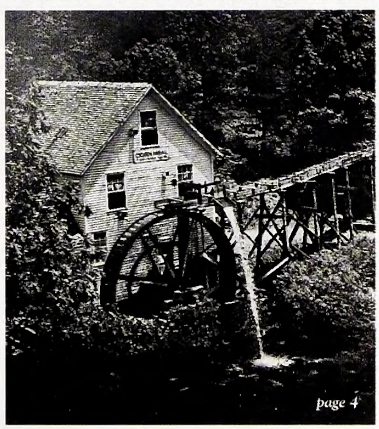

Cover *Autumn paints the hardwood trees along the New River in Ashe County. Photograph by George Humphries* ©1999

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Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 919-733-4376. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

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RIVERS of North Carolina

Rivers of Life

In 1728, in the company of 17 other men from North Carolina and Virginia, the Virginia aristocrat William Byrd set off on a journey that would take him from Currituck Sound to the edge of present-day Stokes County, "no Small part of that Distance on foot." Because the object of the trip was to establish the boundary line between the colonies of Virginia and North Carolina, you can easily follow his path today by looking at a map of North Carolina and tracing the straight line that separates the two states. Most of that line is the legacy of his remarkable journey.

Byrd's journey lay against the grain of the landscape. Most explorers follow the watercourses; to set the dividing line Byrd had no alternative but to go directly across them. Starting from the then Currituck Inlet, he and his men crossed the North River and bushwhacked for 14 days across the dreaded and terrible Dismal Swamp where Atlantic white cedar trees lay "in heaps . . . so that Passage in many places is difficult and Dangerous." A series of river passages followed—across the Northwest , the Blackwater and the Nottaway, the latter two joining to make the Chowan; across the Meherrin (five times), the Roanoke (where it is drowned today in Lake Gaston), the Hyco (five times), the Dan (four times), the Smith, the Mayo and a spider's web of creeks, large and small, too numerous to name—until the Appalachian ramparts halted further progress.

The account of his journey—*History of the Dividing Line*—is so studded with references to rivers, creeks and swamps that the book fairly oozes with water. And what he found is what anyone can discover today: an abundance of rivers and creeks that run in every direction. From the mountains to the sea, more than 40,000 miles of creeks and rivers crisscross the state.

Yet while Byrd couldn't help but be fully occupied by the rivers and creeks he encountered —once his party waited three days for a swollen river to subside—for too many of us, they are an unseen presence. Except for the occasional fishing or canoeing trip, or when flooding threatens, we tend to ignore our rivers. As ecologist Aldo Leopold once complained, most people think rivers' main functions are to "turn turbines, float barges, and carry off sewage."

In the 1990s, however, a series of frightening events has put rivers back in the public eye in North Carolina. First was the fearsome specter of *Pfiesteria*, a lethal organism found in coastal rivers and estuaries that is responsible for killing millions of fish. Then came the hurricanes, the latest of which, Hurricane Floyd, marched ashore in September 1999 to remind us once and for all that we ignore our rivers only at our peril. The human and environmental cost of this shocking storm has brought us face to face with river-related issues that are vitally important to human health and safety. Once again we are debating the effects of wetland drainage in the Coastal Plain, of development in floodplains and of the elimination of forested buffers along rivers.

Yet Floyd's devastation should not obscure what has been a fruitful trend in North Carolina in recent years, and one that this special issue of *Wildlife in North Carolina* takes pride in highlighting. In these pages, we will focus attention on the beauty and usefulness of our rivers and creeks, and on the ecological links that bind us to them in so many ways. But we also wish to underscore the efforts of a remarkable and growing network of local citizens, private organizations, industries and government agencies who are trying to restore the tattered fortunes of our waterways.

In truth, they have only begun their work and, in many ways, they too are working against the grain. But their efforts are crucial steps in the right direction, toward a restoration of our "Rivers of Life." ⊠

"And what he found is what anyone can discover today: an abundance of rivers and creeks that run in every direction. From the mountains to the sea, more than 40,000 miles of creeks and rivers crisscross the state."

From the MOUNTAINS to the SEA

written by Lawrence S. Earley

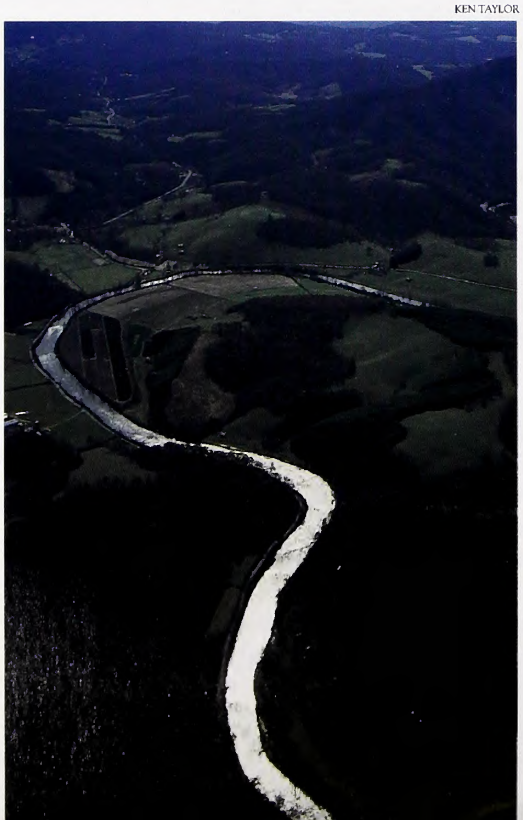
Over North Carolina's varied landscape the music of flowing water is never far away. It's the impetuous rush hour din of whitewater streams that are carving the deep, rocky valleys and gorges of our mountainous highlands. It's also the slower tempos of the blackwater creeks moving in lazy meanders across the broad floodplains of the Coastal Plain. More than 40,000 miles of rivers and streams help knit the state together, each with its own history and personality, each contributing its part in linking the mountains to the sea.

A River is Not a Watershed

On the banks of the South Fork New River in Ashe County, under a sky the color of rumpled bedsheets, I watch the gray river slide by and ponder two large questions: Where are these restless waters going? Where did they come from?

Winding through the rural countryside of Ashe County, the New River is only beginning its lengthy journey to the sea.

KEN TAYLOR



The first seems easy enough to answer. A cursory glance at a map shows me that the New River is headed north into Virginia, the only North Carolina river with such a course. It rises near Blowing Rock and cuts across several mountain ranges until it joins the North Fork near the North Carolina-Virginia line. "The way it cuts through the mountains is an indication that it was here before the Appalachians were formed," says Paul Bailey, park ranger of the 1,530-acre New River State Park. "No one knows the exact age of the river, but we do know it's one of the oldest rivers in North America." The New is ancient.

The river continues to trend northeast into Grayson County, Virginia, turns westward into West Virginia and empties into the Kanawha River, which spills into the Ohio River, which merges with the Mississippi River.

So as ancient as the New River is, it's only a tiny appendage of the younger Mississippi. Indeed, the Mississippi River drains an area of 1.24 million square miles, about two-thirds of the continent, whereas the New River drains only 765 square miles in North Carolina.

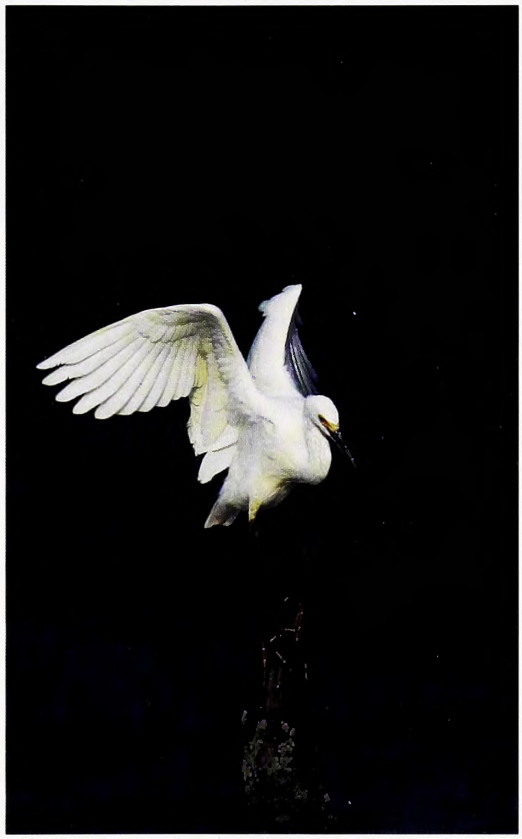
Another thing: Rivers don't always observe political boundaries. The New River is an honored river in North Carolina. Segments have been named a national wild and scenic river, a state-designated natural and scenic river, and an American heritage river, a national recognition bestowed in 1998. Yet its waters lap the territories of six other states before they join the Mississippi, and then five more before they empty into the Gulf of Mexico. Whose responsibility is it to care for a river whose waters flow through so many

municipalities and cross so many county and state lines? Downstream communities—sometimes in different states—often joust with upstream communities over this very question.

We've got a second question to answer: Where does the water in our rivers come from? Rivers run with water as old as the planet itself. The same 326 million cubic miles of water (a cubic mile equals 1 trillion gallons) on Earth today was present 3 billion years ago, not a jot more or less. "Last night's potatoes may have boiled in what was, ages ago, the bath water of Archimedes," writes hydrologist Luna Leopold. The hydrologic cycle means that the same water circulates continually—falling as rain onto land, seeping into underground aquifers or moving overland into creeks, rising through plants or evaporating from the broad oceans to enter the atmosphere as vapor, and falling as rain or snow once again. Our landscape is alive with the urgency of moving water, whether it's boiling and tumbling in mountain headwater streams or meandering in lazy loops through a coastal floodplain.

A river system, complete with its network of creeks and streams and nameless rivulets, is called a watershed. John Wesley Powell, who led the first expedition through the Grand Canyon in 1869, described a watershed as "that area of land... within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of the community." There is no more important community than this one, commanding equal fealty from largemouth bass, great blue herons, white-tailed deer, monarch butterflies and 5-year-old children skipping to school.

An egret rises gracefully from its perch along a coastal river.



F. EUGENE HESTER

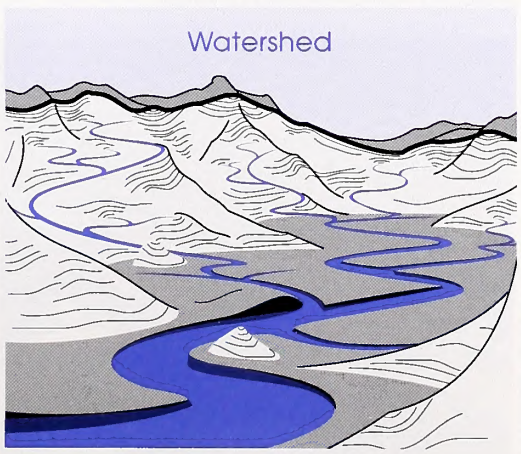
A river is not a watershed

All of them depend on our watersheds.

Thus, the river is one thing, but the watershed is a larger, more important entity that links town to city, county to county, and state to state. It connects the mountains to the sea.

Rivers Brought the Mountains to the Sea

Leaving the New River State Park, I drive to Sparta and then southeast along U.S. Highway 21. I cross the Eastern Continental Divide and celebrate with a brief swig of a soft drink. Geologically speaking, it's a momentous event. On one side, the waterways flow west and southwest toward the Mississippi River, and ultimately to the Gulf of Mexico. On the other, flowing water heads east and southeast toward the Atlantic Ocean. Within



GRAPHIC BY ERIN HANCOCK

***Precipitation** falling in higher elevations runs downhill in rivulets that join to make small streams. These tributary streams flow into rivers farther downstream. A watershed is the area drained by each creek or river.*

The eroding power of river water hurrying to the sea is the chief architect of the landscape, carving deep gorges like the Linville River Gorge.

KEN TAYLOR

rivers brought the mounta

just a few miles of each other, two creeks can have widely divergent destinations.

I turn off onto Haystack Road and follow it into a heavily pastured valley looking for the Mitchell River. Near the community of Devotion, by a sparkling stream flanked by a semicircle of sycamores and crossed by a one-car bridge, I get out to take a photo. A great blue heron rises ponderously from the gravel flats.

Standing on the bridge, I'm suddenly aware of a lot of negative space. Hundreds of millions of years ago, the Appalachian Mountains towered tens of thousands of feet high. Mount Mitchell at 6,684 feet is a stripling compared to these once-Himalaya-sized behemoths. But they are gone now, leaving a mere 5,000 feet of mountain behind them.

The declining numbers and species of freshwater mussels in North Carolina's streams are indicators of severe human impacts on rivers.

KEN TAYLOR

Where did they go? Over unimaginable eons of time, pelting rain and howling winds gradually whittled down the huge mountains, turning boulders into rocks, rocks into pebbles, and pebbles into grains of sand. The rivers ferried these mountain shavings on a turbulent journey to the sea, carving precipitous gorges, V-shaped valleys and U-shaped floodplains. Rivers took eroded mountain debris and created the Coastal Plain with it. They even created the continental shelf with it.

So where are the missing mountaintops? They lie here, in this pleasant valley traced by the Mitchell River. Farmers in Northampton County are sowing seed in the remnants of these missing mountains. Forest growers in Bladen County are planting longleaf pine in sandy soils that million of years ago were part of the mountains. The mountaintops lie deep beneath the beaches of Cape Hatteras.

Bad Things Happen to Good Rivers

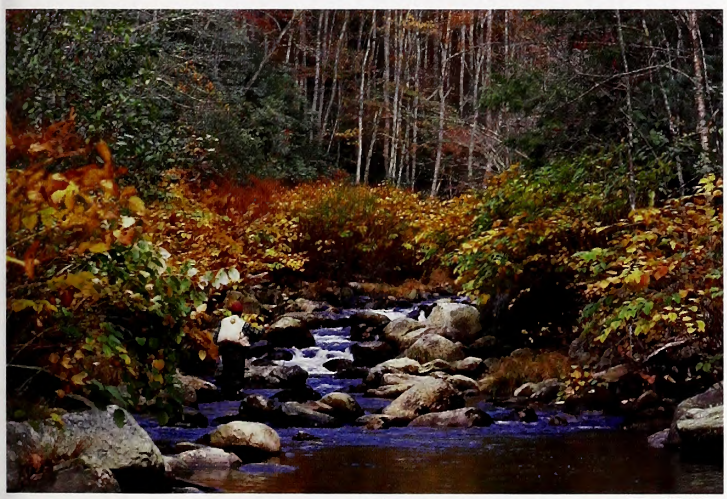
One February day, I drive north from the Triangle to find the headwaters of the Tar River. The Tar rises in two forks and travels for 208 miles through the beautiful old tobacco land of Person and Granville counties, through the growing metropolis of Rocky Mount, past historic Tarboro and the university town of Greenville. Then, at Tranter's Creek, in Beaufort County, the Tar spreads out and joins the upreaching, drowned river known as the Pamlico.

Up here in Person County, folks have been farming the land for the golden leaf since pre-Revolutionary times. It made them wealthy once, although as I drive the two-lane hardtops, mostly what I see are derelict barns that recall a bright-leaf tobacco culture that has all but faded. I stop

at bridge crossings to see the Tar murmur gently, following its urgent purpose.

On the banks of the Tar River near the town of Berea, Gooch's Gristmill once operated. The stone foundations of this old gristmill remind me that rivers played a critical role in the peopling of North Carolina. Rivers were avenues of immigration for settlers, who followed the rivers up to the Fall Line, building plantations and farms on the rich bottomlands of the Coastal Plain. And everywhere they went they built hundreds and hundreds of water-powered gristmills to grind corn, and sawmills to turn the great pine and hardwood forests of the region into valuable commodities. For nearly two centuries, the commercial products of North Carolina were conducted to the port cities—Edenton, New Bern, Washington, Bath, Wilmington—down river highways. The whims of seasonal water flow dictated their passage. In summer and fall, when river flows were low, commercial activity on the rivers slowed; when winter brought freshets of high water, rafts and boats would be laden with lumber, tar, turpentine and other goods and floated to market.

ns to the sea



JOEL ARRINGTON

This cold-water mountain stream offers solitude and beauty to an angler fishing for trout.

North Carolina's rivers helped create wealth, but in Tarboro I learned how that process has harmed our rivers as well. On a bluff in River Front Park overlooking the Tar, N.C. Wildlife Resources Commission biologist John Alderman and I talked about the river. The lovely white bark of sycamores marked the river's edge below us.

"In the 1960s, a biologist named Arthur Clarke could find yellow lance mussels in abundance on a big, exposed sandbar right down from where we're sitting," John tells me. "When I went looking for them in the 1980s, I couldn't find any. Once Beech Branch had the best green-lance population in the Tar River basin. Not now."

N.C. WILDLIFE RESOURCES COMMISSION

The water flow of rivers and streams once powered thousands of grist mills across North Carolina.

John's work with freshwater mussels over the past decade has made him understandably glum. Mussels comprise a unique part of the region's natural heritage. Fifty percent of all freshwater fish species in the United States occur in the Southeast; so do 75 percent of the aquatic snail species and about 90 percent of 600 species of North America's mussels and crayfish. North Carolina's share of these freshwater creatures is large, yet everywhere in the Southeast, as in North Carolina, aquatic biologists are seeing fewer and fewer of them. According to a recent report from the Southern Appalachian Forest Coalition, "many of the region's streams have experienced a 50 percent decline in species during this century." Closer to home, 18 percent of the state's 217 freshwater fish species are either endangered, threatened or of special concern, and 75 percent of the freshwater mussels are either extirpated, endangered, threatened, of special concern or significantly rare.

Like the canary in the mine, these figures tell Alderman something fearful is going on in our rivers.

"I say to myself, 'Man, there's a message here for us. And the message is: As long as these animals can exist in the river, we can be comfortable drinking the water. But when we can't find them . . . ."

"We've lost more aquatic diversity and species abundance since the passage of the Clean Water Act of 1972, the Clean Air Act and the Endangered Species Act than in the same number of years before passage of these acts," he added. "It's very depressing. Something is going on. I just can't explain the disappearances of species. For example, Lake Waccamaw and the Waccamaw River are protected by swamps. Yet biologists saw species there in the '60s that I can't find today.

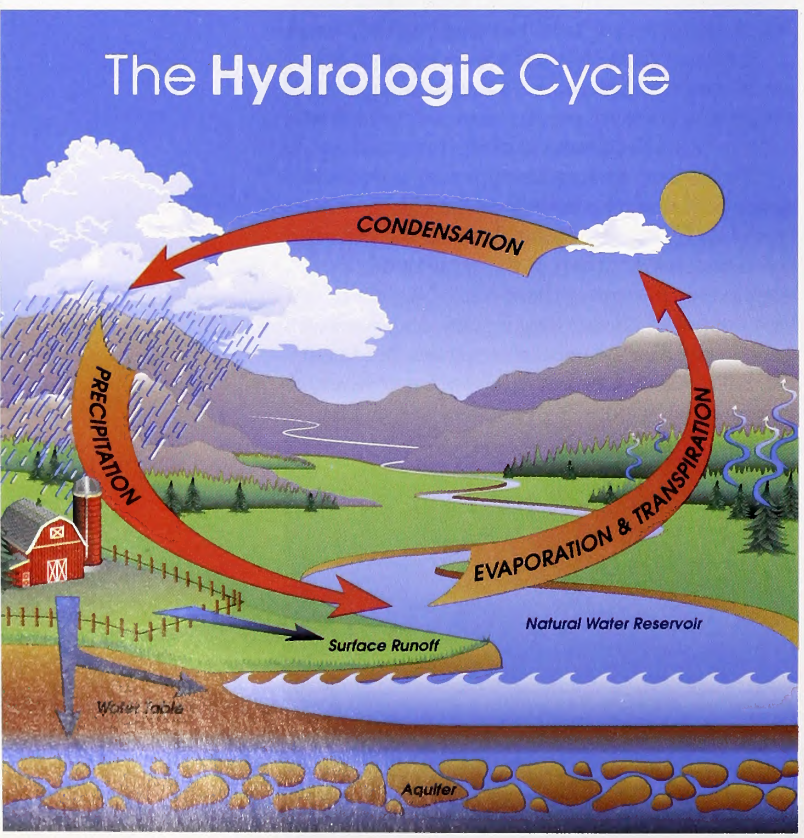
"What gets me is that these animals have been here for millions of years, and now we're seeing them disappear in our lifetime."

The Tar has long had a reputation for having the highest erosion rates in the state, with heavy loads of sedimentation that can smother mussels in their beds. But sedimentation, by itself, may not be the reason why the Tar River spiny mussel, the yellow lampmussel and the yellow lance are so rare in the watershed today. After all, the Tar's tributaries, Swift Creek and Fishing Creek, once flowed through some of the most extensively farmed areas in the state, but they still have large

The Tar River carries its load of sediment and pollution into the shallow waters of Pamlico Sound, the second largest estuary in the country.

KEN TAYLOR

The Hydrologic Cycle *shows that water on earth circulates continuously—falling as rain, seeping into the ground to recharge aquifers and running along the surface into rivers. Then, powered by the sun's heat, water evaporates and transpires into the atmosphere as a gas where it condenses and falls again as rain or snow.*



GRAPHIC BY ERIN HANCOCK

mussel beds in places. The difference may well be that that farmland has grown up in forest today.

"The land played out and went into woodland in the 19th century before artificial fertilizers and pesticides came along," John says. "Pesticides poison mussels, because these organisms filter their food from the water and end up taking up whatever contaminants are present as well.

"It's such a simple message," he says. "If you want clean water, you have to have woodland." It's a message that is reaching many conservationists as they establish forested riparian buffers that will protect rivers like the Upper Tar.

Rivers Run to the Sea

Where the Tar enters the Pamlico is one of the state's greatest natural water bodies, and one of the nation's, too. "The Pamlico is among North Carolina's most important natural and economic resources," said Joe Ramus of the Duke Marine Lab in Beaufort. "It is a nursery area of most of the commercial fish species from the mid-Atlantic and south Atlantic bights." Pamlico Sound is the second largest estuary in the nation, next to Chesapeake Bay. Together with the Albemarle Sound, it drains more than 30,000 square miles in both Virginia and North Carolina, forming a vast but shallow lagoon of about 17,000 square miles, making it the nation's largest inland sea.

The sailors of wooden boats knew well enough how vast and shallow it was. In 1768, the brig *Joannah*, bound for England from the West Indies, stopped in the Edenton region to pick up goods. Leaving Edenton for England on May 7, the brig took 10 days just to get through the hazardous shallows of Pamlico Sound and clear the Outer Banks.

With five major rivers emptying into it and the neighboring Albemarle Sound, the Pamlico processes nearly half of the freshwater runoff from the entire state. Most of this runoff sits in the shallow bowl, blocked by the sandy barriers of the Outer Banks. East Carolina University geologist Stanley Riggs describes them and their four inlets as a "sand dam with tiny pinholes in it." The Tar-Pamlico river system differs markedly from the Cape Fear River in this respect; the Cape Fear flushes directly to the Atlantic Ocean, but the Tar-Pamlico's waters can pile up behind the "sand dam" for months. In fact, most water exiting from Pamlico Sound does so not through these inlets, but by means of evaporation.

It's in the estuaries, the fertile habitats where fresh and salt water mix, that the great erosive force of rivers meets another—rising sea level. Riggs' work on the Pamlico has helped to chart not only its current troubles but also its ancient geological history. The great Pamlico estuary is the result of a great river valley being drowned, along with all of its tributaries, by rising sea level beginning about 10,000 years ago.

"During the glacial maximum, the shoreline was 30 to 60 miles offshore—400-plus feet lower than it is today," Riggs says. "The Tar River, just like every other one of these rivers, ran all the way to the edge of the continental shelf and over the

shelf and into a submarine canyon beyond. The continental shelf was once forested, and animals roamed these vast plains."

But rising seas drowned the ancient Tar, and the process continues today. "Pamlico Sound used to be a tributary creek to the Tar River," Riggs says. "Southern Roanoke Island was connected to the mainland, with a small Croatan Creek flowing north of the interstream divide, and into the Roanoke River. With rising sea level, both Pamlico and Croatan creeks were flooded. Finally, after 1817, sea level breached the divide, connecting Croatan and Pamlico sounds and separating Roanoke Island from the mainland. If sea level continues to rise, the Alligator River will flood right across the interstream divide, and we'll end up with another irregularly shaped Roanoke Island. There will be a sound through there."

That's the way Roanoke Sound and Croatan Sound formed. It's also the process that gave birth to Currituck Sound, Core Sound and Bogue Sound, all small tributary creeks that were drowned.

The inefficient flushing action of the Pamlico Sound caused by these geological processes has serious consequences. Each of the rivers flowing into it is heavily polluted and whatever pollutants are carried into the sound by its tributary rivers remain there for long periods of time.

Is it any wonder, then, that some fear the Pamlico and Neuse river estuaries and Albemarle Sound are turning into vast sinks of pollution? Any wonder that massive die-offs of marine fish have occurred in the tributaries that lead to the sounds?

"What's happening in the estuaries is totally predictable and will continue until we stop using our rivers as sewers and allowing our chemical wastes to be discharged into them," Riggs says.

A River is a Sacred Trust

For decades, thousands of North Carolina's citizens have been engaged in sometimes extraordinary efforts to change the way we look at and treat our rivers. A tireless advocate for river protection in general and for the Eno River in particular was the late Margaret Nygard of Durham, whose drive and passion almost single-handedly saved the river from encroachment. Nygard's activism with the Eno River Association resulted in the creation of the Eno River State Park. Peg Jones, of Franklin, has followed in her footsteps as the crusading president of Save Our Rivers Inc. and the executive director of the North Carolina Watershed Coalition Inc. Scores of other river groups and land trusts are focusing on river conservation as well. Each spring and summer, growing numbers of festivals on scores of rivers and creeks celebrate the waterways' importance to local communities.

More recently, the state and federal governments and even industries have followed suit, bringing needed attention and money to the effort. The Clean Water Management Trust Fund is pumping tens of millions of dollars into local projects, and millions of federal and state dollars are being earmarked for riparian protection, including a recent infusion of $220 million as a result of the Conservation Reserve Enhancement Program (CREP). Some farsighted industries are spearheading important watershed protection efforts on their lands.

The energy is high-octane and infectious, and the message is clear: Clean water ought to be a birthright, its conservation a sacred duty entrusted to each citizen and to each generation. What we do in our watersheds ultimately affects striped bass, freshwater mussels, the not-quite-inexhaustible ranks of oceangoing fish and shellfish, and even ourselves. Rivers are our lifelines, connecting past to present and present to future. ⊠

a river is a sacred trust

MELISSA McGAW

In the estuary, a fisherman's haul depends on many things, including the quality of the water flowing from the mountains past the populated urban centers of the state.

The Once & Future Little Tennessee

Two centuries ago, botanist William Bartram followed the Little Tennessee River through the Nantahalas and into history books. Though the river still contains some of the most pristine water in the state, sediment is threatening its aquatic life and ruining its reputation. Is it too late to clean it up? A coalition of the river's friends is proving once again that all things are possible to those who work together.

written by Burt Kornegay ©1999

photographed by Ken Taylor

In January 1926, real estate salesman Alvah Pearce took out a full-page advertisement in the *Franklin Press* with this headline: "LAKE EMORY FRANKLIN'S BEST A PARADISE THE YEAR AROUND."

Pearce wanted to develop a resort around the newly created Lake Emory on the Little Tennessee River, near Franklin in Macon County. He envisioned golf and tennis courts, roads and houses, as well as fishing, swimming and boating on the lake's "crystal waters."

The town shared Pearce's dream of developing paradise. In a front-page article that same day, the newspaper announced that Franklin had completed construction of the Lake Emory dam and power plant. The 7-mile-long lake backed up by the dam would spark a boom in resort construction; the abundance of electrical power produced by the dam would spur industrial development; and the money the industries paid Franklin for electricity would make it "a tax-free town." But, according to county historian Barbara McRae, the plant proved to be an economic drain; in just three years the town was desperately searching for a buyer. And Lake Emory, that transparent "Lake of Lakes," began to turn into a 225-acre wallow.

What happened? Massive erosion washed millions of tons of soil from the surrounding mountains down into the Little Tennessee, and the river swept the sediment into Lake Emory's still waters. The steady stream of sediment was fed by the logging of virgin forests in the watershed, and also by the bulldozing of hundreds of miles of dirt roads, by farming and pasturing of cattle and hogs on steep mountainsides, and by mining. Some 80 inches of rainfall a year kept the sediment flowing downward.

In May 1775, the Philadelphia-born naturalist William Bartram, following a Cherokee trading path to the river, found paradise already at the Little Tennessee. From the river's headwaters down to the Cherokee town of Cowee, not far from present-day Franklin, Bartram rode his horse through "expansive, lucid, green, flowery fields . . . . Magnificent high forests...meadows and lawns...one of the most charming natural mountainous landscapes perhaps any where to be seen." And through it all glided the Little Tennessee, "as a vast serpent rushing after his prey." When Bartram forded the river, he could see the bottom, "level, and covered evenly with pebbles," even though the river was still "greatly swollen by the floods of rain that fell the day before." An

WILLIAM ROSTON

Yellowfin shiners

LITTLE TENNESSEE RIVER BASIN **FACTS**

~

Mississippi drainage

~

Size of watershed: 1,800 sq. mi

~

Total streams and rivers: 2,702

~

Major tributaries: Nantahala, Cheoah, Oconaluftee, Tuckasegee, Cullasaja and Cartoogechaye rivers

~

Municipalities: 8

~

Population: 67,083 (1990)

~

Major land use: Forest

~

States flow through: Ga., N.C., Tenn.

estimated 3,000 Cherokees lived in the valley and farmed corn along the river. But any erosion they caused was minimal compared to what modern man—with his earth-moving machines—brought on early in this century.

Bartram's ride down the Little Tennessee covered one quarter of the river's length. Arising at the confluence of Betty and Keener creeks in Rabun County, Ga., the "Little T," as it is affectionately called by many, flows north seven miles before passing into North Carolina. For the next 25 miles to Emory Dam, it meanders down its wide valley through farmland and pastures, passing scattered houses and businesses. The valley is flanked by the Fishhawk and Cowee mountains to the east and by the Nantahalas to the west, rising 3,000 feet above the valley floor. In the 25 miles below Lake Emory, the river bends from north to west, becoming rocky, swift and wild as it squeezes between the Cowees and Nantahalas, forming the Little Tennessee River Gorge.

In Bartram's day, the river grew even wilder beyond this, as it passed the Great Smoky Mountains. Then, turning north once more, the river flowed out of North Carolina into Tennessee, where it joined the Tennessee River near present-day Lenoir, 145 miles from its start. But beginning with the construction of Cheoah Dam in 1919 and ending with the completion of Tellico Dam in 1979, this lower two-thirds of the river disappeared beneath a series of reservoirs. Built by the Tennessee Valley Authority, Alcoa and Nantahala Power and Light Co., these reservoirs provide hydroelectric power, control flooding and give boaters a place to play. But they have also drowned what was one of the most beautiful rivers in the East.

Luckily, the river's gorge from Fontana Reservoir up to Franklin retains much of its wild beauty. The houses and roads disappear and a lush forest blankets the mountain slopes. Forester Paul Carlson, of Franklin, says the gorge contains "the largest expanse of relatively undisturbed 'montane alluvial forest' " in western North Carolina. And according to botanist Dan Pittillo, of Western Carolina University, this rich forest contains such rare species as mountain camellia and wild petunia, as well as plants unusual in the mountains—most unexpectedly, prickly pear cactus.

The river here retains something even more important than beauty or botanical complexity—something that no other river in the Blue Ridge and perhaps in the entire East has been able to keep: its full assemblage of native aquatic animal life. This includes many species of freshwater animals that have disappeared from other streams. The rare species include seven species of mussels, making the Little T one of the two most significant mussel sites in the state (the other being the

Tar River). The Little T is also home to three rare species of fish, including the yellowfin shiner shown on page 11, the bog turtle and four salamander species. As Carlson puts it, the Little T above Fontana Lake represents just 1 percent of the entire Tennessee River watershed, but it contains 25 percent of all fish species found in that much larger river system.

For the past five years, Chris McGrath of Asheville has been studying the Little T's rare species. McGrath is a nongame biologist with the N.C. Wildlife Resources Commission, a job that includes the study and management, as Chris puts it, of "everything not hunted or fished" in the Mountains. Of particular concern to him are the Little T's mussels—especially the Appalachian elktoe and the littlewing pearlymussel, both of which are on the federal endangered species list. Many species of mussels, invertebrates with hard shells and soft inner bodies (think of them as freshwater versions of clams), thrive only in the kind of clear, rocky rivers like the gorge stretch of the Little Tennessee. The mussels dig into the stream bottom, filtering water through their gills

Sediment has *essentially turned the Little Tennessee River into two rivers—the pristine, species-rich stretch below Lake Emory (above), and the muddy, sediment-clogged stretch (left) above the lake. Much of the smothering silt in the upper river comes from runoff from agricultural fields, dirt roads and the clearing of land for new homes and businesses.*

to extract food particles. When they reproduce, mussels give birth to microscopic larval mussels, called glochidia, which attach to fish and extract nutrients from them. After a short time the glochidia drop off and begin to grow shells. The little wing pearlymussel is so secretive that in McGrath's five years of looking for them in the Little T, he has found but one living specimen and half a dozen shells.

Above Lake Emory, however, the river cannot be called pristine or rich in native species. As it winds through fields and meadows, the river probably does look similar to what Bartram saw from the summits of the Nantahalas. But look closer and problems appear. Rabbit Creek flows into Lake Emory one mile upstream of the dam, and in May, I met Dr. Bill McLarney, an aquatic biologist, above the creek's mucky confluence with the lake. With McLarney was Jason Stone, a student majoring in biology and environmental health at WCU. As I approached, the two of them were pulling gear from a pickup truck, including a "fish-shocker"—a gas-powered generator with two 8-foot-long metal "probes" that direct electric current into water to stun fish temporarily. They were awaiting the students of Joan Willis' Environmental Science class at Franklin High who were helping them obtain an Index of Biotic Integrity—or IBI—on Rabbit Creek. With such volunteer help and with financial sponsorship from the TVA, for the past 10 years McLarney has obtained some 30 IBIs annually of Rabbit Creek and other tributaries of the Little T, as well as of the river itself.

An IBI is a score that measures a stream's biological diversity and health based on the assumption that "the fish know more about water quality than you or I do," McLarney says. By that he means that the kinds and numbers of fish living in a particular stream indicate how polluted and changed by human activities that stream has become. To obtain an IBI, McLarney must find out how many pollution-tolerant fish species live in the stream compared to pollution-intolerant ones; how many native fish are there versus how many that are exotic or introduced; how many fish show signs of pollution-caused disease or deformity. IBI scores range from a "very poor" rating of 12—"few fish present, mostly introduced or very pollution-tolerant"—to an "excellent" rating of 60—"no detectable human influence; all regionally expected species...including the most pollution-intolerant forms, are present." In other words, McLarney says, an IBI on Rabbit Creek will tell us "how this stream stacks up."

When the students arrive, McLarney has them put on chest waders and rubber gloves, not only to keep them dry but to protect them from the shocker. Three students wade into Rabbit Creek and spread a 20-foot seine from bank to bank. Three more students carrying dip nets follow McLarney into the creek 30 feet upstream, while two others stand nearby, one holding a 5-gallon bucket and the other a clipboard with an IBI score card.

Stone, wearing the fish shocker like a backpack, wades into the creek. He starts the machine and, holding the probes in front of him, sends an electric current into the creek. As Stone moves downstream towards the group, stunning fish,

McLarney and the students begin scooping up any fish they see floating to the surface and emptying them into the bucket. The aim is to catch every single fish in that stretch of the creek. As Stone nears the seine net, herding all remaining fish before him, everyone pulls the net up on shore, exposing its scaly contents.

McLarney kneels and starts counting: "three warpaint shiners; four mottled sculpin; five Northern hogsuckers—no make that six; one white-tailed shiner...with a diseased fin; five river chub; seven central stonerollers." The student with the notepad hurriedly jots down the numbers. McLarney counts every single fish they've caught, from a rock bass 10 inches long to inch-long minnows. He puts the stunned fish back into the creek a hundred yards downstream, where most of them will recover, then moves the group of volunteers to another position.

After nine sessions of shocking, netting and counting, McLarney uses a calculator to add up the number of fish they've caught—439. Then he figures the percentages of fish by species. Entering these percentages into a rating scale, he finally gets what he's been looking for—an IBI number for Rabbit Creek. It is 38.7. This may not look like much of a catch, but it tells McLarney that on the IBI scale of 12 to 60, Rabbit Creek hovers between the poor and fair categories. We compare this score to IBIs conducted on the relatively pollution-free stretch of river below Lake Emory. There, IBIs as high as 56 have been recorded—the highest of any river in the state.

McLarney says, "At least 38.7 is better than the low score of 17 that Rabbit Creek got back in 1990"—the year he conducted his first IBI there. Rabbit Creek has made some strides toward biological health. But this recovery can easily be reversed by new sources of pollution in the watershed.

What kind of pollution has so degraded—and still threatens—Rabbit Creek? The same kind that turned Emory into a lake of mud.

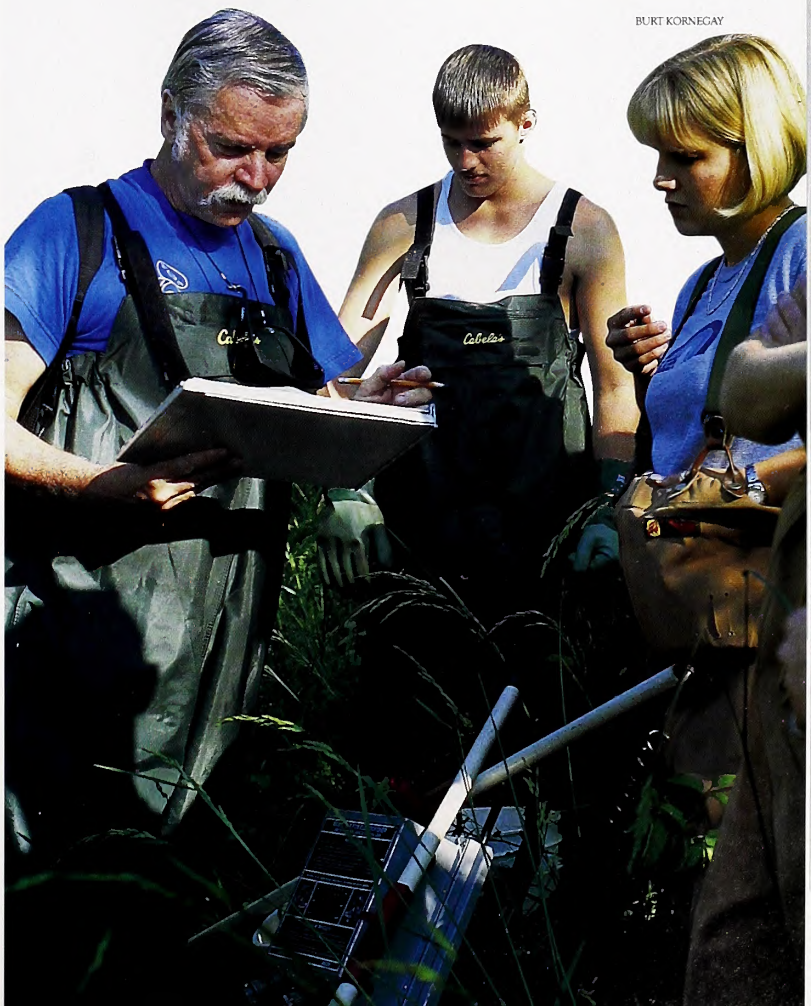
"Dirt, red clay, plain old mud," McLarney says emphatically. Sediment is slowly eliminating the rare fish and mussels that make the Little Tennessee unique, while ruining the sport fishing, diminishing the natural beauty and spoiling recreational opportunities." How is plain old mud so harmful? For one, the species in the river have evolved over millions of years to live in clear water. But large amounts of sediment eroding into the river settle on its bottom, obliterating the sandy and gravelly areas where fish spawn. The sediment can smother the bottom-dwelling mussels too, and it also makes it difficult for them to strain food from the silt-laden water. In addition, because young mussels are dependent on fish hosts, when fish numbers decline, mussels do too.

Sediment has essentially turned the Little Tennessee into two rivers. There's the rare-and-native-species-rich stretch below Emory Lake, largely sediment free, and the sediment-clogged, species-depleted stretch above. Since 1926, the river below the lake has been spared the worst of the pollution because the lake has served as a giant sediment trap or "plug," eddying the muddy water from upstream and giving the sediment time to settle. But today the lake is no longer an effective plug, and the upstream portion of the river continues to receive heavy erosion.

Much of the erosion still comes from fields, pastures and dirt roads. But in the past 20 years a new cause of erosion has emerged. This cool and beautiful mountain valley—just a 90-minute drive from Atlanta and the first large valley people see when they drive into the mountains from Florida—is experiencing some of the fastest population growth in western North Carolina—28,000 residents and climbing. And every new home or business built means more land cleared, more roads constructed. Even with state-mandated erosion controls in place, so much development sends a lot of mud into the river.

Realizing the threat that development poses to the river, a group of citizens in 1993 co-sponsored the two-day Little Tennessee River Conference. Around 200 environmentalists, scientists, sportsmen and professionals attended. As a result of the enthusiasm generated by that conference, Bill McLarney, Paul Carlson, Ann Seaton, Levourn Wiggins and others formed the Little Tennessee River Watershed Association, or LTWA, with Brian Hyder as its chairman. Their goal is to work with public agencies, community groups, and landowners to "develop and implement a strategy for the conservation and improvement of the water quality and habitat of the Little Tennessee River

BURT KORNEGAY



***Despite threats** from sedimentation, the Little Tennessee River contains the richest diversity of aquatic life in the North Carolina mountains. Dr. Bill McLarney (below left) works with students from Franklin High School to measure the health of Rabbit Creek, a tributary of the Little Tennessee, based on its fish species.*

JOEL ARRINGTON

Covering more than 1,800 square miles, the Little Tennessee watershed is composed of a diverse group of mountain rivers and streams. The Nantahala River, one of the Little Tennessee's major tributaries, provides excellent recreational opportunities including white-water rafting and fly-fishing for mountain trout.

and its tributaries upstream of Fontana Reservoir."

In a nutshell, the LTWA hopes to preserve the pristine portion of the river below Lake Emory and to stabilize and restore the eroding banks of the river and its tributaries above the lake. Since an estimated 20 percent of the river's banks above Lake Emory are raw and caving in, that's an ambitious goal. To determine the sections that most need work, the LTWA implemented a sediment monitoring program with 54 monitoring sites—making the Little T, as Carlson puts it, "the most intensively monitored watershed in North Carolina." The LTWA uses the information it gathers to decide which areas to restore first. Then, once an eroding site has been stabilized, the same monitoring sites measure the success of those efforts.

In April, I walked into a small office in Franklin and met the three men responsible for directing streambank restoration—Jamie Johnston, executive director of the LTWA; Doug Johnson, a river restoration technician working for the Macon County Soil and Water Conservation District; and Levourn Wiggins, with the Natural Resource Conservation Service. We talked about their coordinated efforts to stop erosion on the Little T. Levourn told me that in January 1995 the watershed association and the soil and water conservation district placed ads in the Franklin paper announcing their readiness to work with local landowners to stop streambank erosion. The ads drew an immediate response. As one farmer said, "I'm tired of watching my fields wash down into Fontana Lake."

Working with landowners, the river restorers completed four streambank stabilization projects that year and 18 more since then, stabilizing some four miles of streambank all told. Another four projects are under construction, and 30 landowners are on a waiting list. Landowners must pay roughly one quarter of the cost of the project; the other three quarters are paid by the state through the Clean Water Management Trust Fund. Also, the landowner must pledge to maintain the project for at least 10 years.

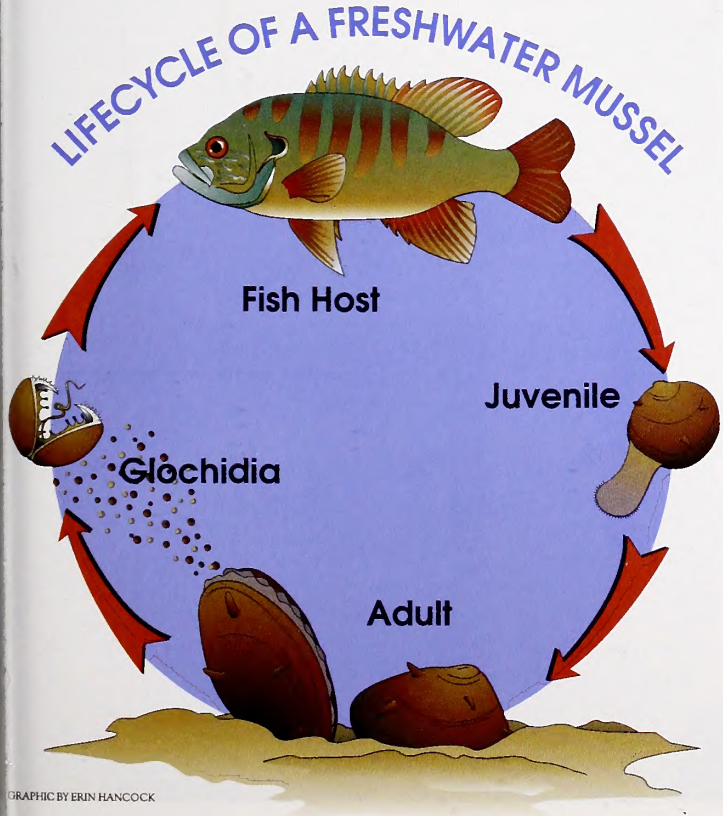
The four of us drove to Gilmer Henson's dairy

farm in Otto, eight miles south of Franklin, to look at one of the early restoration projects. The problem Henson faces is typical of landowners on the river: for years the Little T has been eating into his pasture. "Every time you'd have a flood, you'd lose 4 to 5 feet of land," Henson explains. Then, pointing to the bend where the river is today, he says, "I used to cut silage out there in that hollow space." Henson saw the restoration work done on a nearby farmer's land and wanted the same for his.

To deal with the problem, the river restorers and Henson took a three-step approach. First, they built a "revetment"—a barricade of fallen trees —on the raw riverbank. They cut trees distant from the site, hauled them—branches and all—to the river with a backhoe, and placed the trees against the bank down to the river's low water level, with the tree butts facing upstream. They anchored the barricade to the bank with steel cables attached to "deadmen"—buried railroad ties. The tree revetment is a simple, cheap, ingenious structure that not only protects the raw bank from eroding water, but actually causes the river, when in flood, to swirl and eddy among the many branches and trunks where it drops its load of silt. Instead of stripping land away, flooding now rebuilds the bank. To show me how well it works, Johnson climbs down among the barricade of trees to stand on newly deposited soil.

As the second step in the stabilization project, workers sowed a 35-foot-wide swath of grass on the riverbank and planted black walnuts, sycamores, red maples and dogwoods. The idea is to further protect the bank with a buffering "riparian zone" of forested vegetation, which will also stop runoff into the river from the pasture. Third, the river restorers put up a barbed-wire fence between the riparian zone and the pasture to keep cattle out. Henson's cattle now get their water from a spring-fed trough. "There's not been any more caving in [of the river bank] since we did this," Henson said. And perhaps someday land will once again fill what he calls "that hollow space."

The pristine waters of the Little Tennessee gorge are home to some of the rarest freshwater mussels in the country, including the endangered Appalachian elktoe and the little pearlymussel. The sedentary mussels depend on fish to unknowingly transport their microscopic young, called glochidia, to other stretches of the river.



GRAPHIC BY ERIN HANCOCK

Cullasaja Falls

"If every foot of bank along the river and its tributaries... had a forested riparian zone just 20 feet wide, such a buffer would keep land from washing away, protect water quality, preserve aquatic wildlife and enhance the river's beauty for everyone." —*Paul Carlson*

A week after my trip to the Hensen farm, I stood with Paul Carlson looking over the beautiful valley of Cartoogechaye Creek, west of Franklin. Paul heads up the Nikwasi Land Trust, a nonprofit organization which, along with the Little Tennessee Watershed Association, formed after the 1993 conference. Though the LTWA concentrates on streambank stabilization projects, the land trust works one on one with landowners and local government to obtain permanent protection for important riverbank properties, either through conservation easements or the purchase of land. Paul says, "If every foot of bank along the river and its tributaries, like Cartoogechaye Creek, had a forested riparian zone just 20 feet wide, such a buffer would keep land from washing away, protect water quality, preserve aquatic wildlife and enhance the river's beauty for everyone." Out of the 300,000 acres in the Little T's watershed, such a forested buffer would take up but 900 acres total. As we walk down to the creek to see a recently stabilized and planted bank, courtesy of the Wildlife Resources Commission, I think to myself, more power to Paul, Bill, Levourn, Jamie, Doug, Gilmer and all those who are striving to reforest those 900 acres. If successful, they will move the Little Tennessee closer to being once again "paradise the year around." ⊠

Hiwassee
Refuge of the Cherokee

The waters of the Hiwassee River system originate in the mountains of Georgia and flow north through North Carolina before veering west into Tennessee to join the Tennessee River on its way to the Gulf of Mexico via the Ohio and Mississippi rivers. The Hiwassee system drains more than 750,000 acres of land, most of which lies in the Chattahoochee (Ga.), Nantahala (N.C.) and Cherokee (Tenn.) national forests.

Within North Carolina, the Hiwassee River and its primary tributaries—the Nottely and Valley rivers—are located in Clay and Cherokee counties in the far southwestern tip of the state. Water flow is regulated by the Tennessee Valley Authority for the production of hydroelectric power via three impoundments: Chatuge Lake on the Georgia-North Carolina line near Hayesville; Hiwassee Lake just northwest of Murphy; and Apalachia Lake adjacent to the Tennessee line. Since most of its streams drain undisturbed and undeveloped mountain areas, the water quality in the basin is generally good, according to the N.C. Division of Water Quality.

The Hiwassee's name is derived from "Ayuhwasi," a Cherokee work that signifies a savanna or meadow. This name also referred to at least two important Cherokee settlements, one in Tennessee and the other where Peachtree Creek empties into the Hiwassee above the present-day town of Murphy. Traditional Cherokee settlement areas in western North Carolina were known as the Middle Towns, but the villages along the rich floodplains of the Hiwassee and its tributaries were so numerous they received additional recognition as the Valley Towns.

KEN TAYLOR

***At Murphy,** the morning sun colors the mist rising from the confluence of the Hiwassee and Valley rivers. A blacksmith stokes his forge (above) at the John C. Campbell Folk School in Cherokee County.*

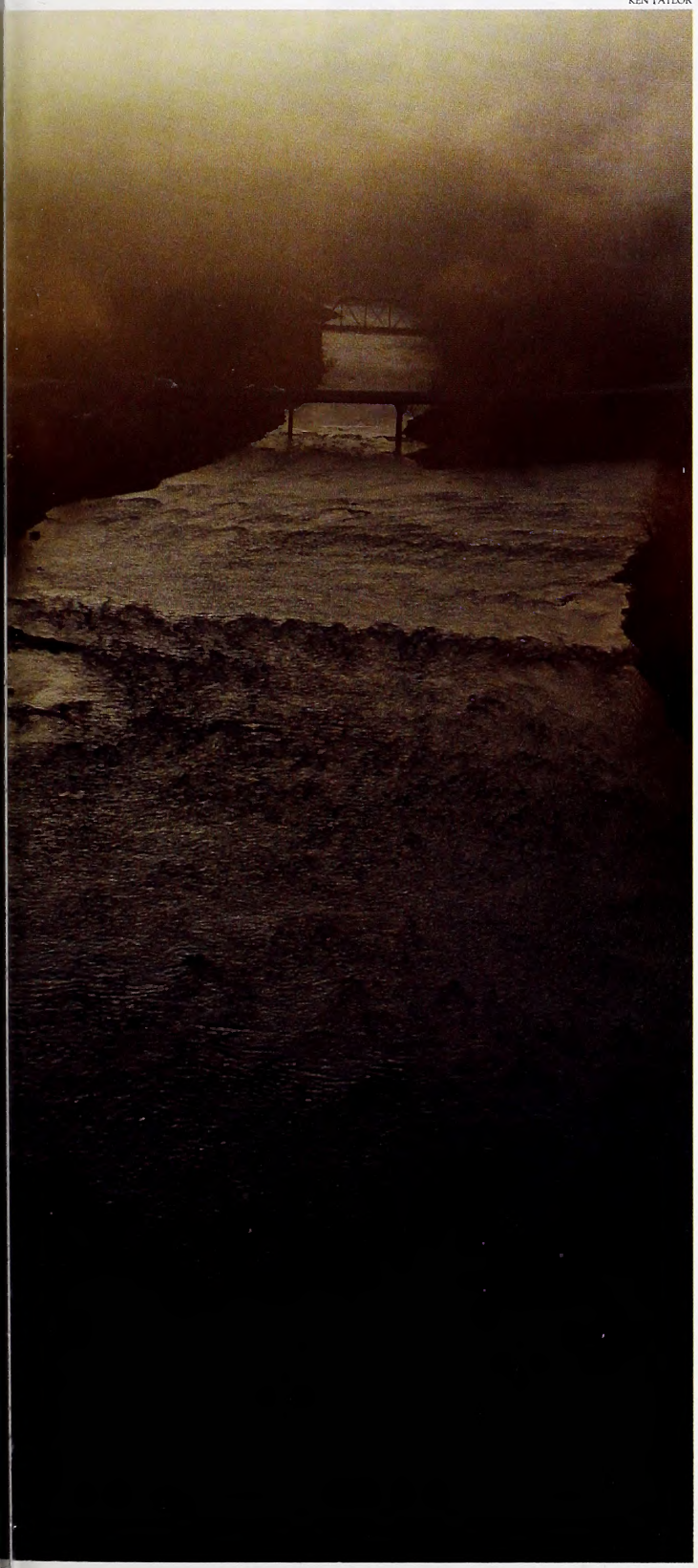
Within the last decade there has been much debate over Hernando DeSoto's exact route through North Carolina in 1540, with some authorities opting for a northerly route along the French Broad into Tennessee. But other anthropologists—along with practically everyone in Cherokee County—insist that he visited Peachtree Mound on the Hiwassee, one of the most significant Cherokee sites ever excavated in North Carolina. Their position is bolstered by numerous glass trade beads and Spanish implements unearthed in the area.

Following the Treaty of 1819, the majority of the Cherokees in North Carolina were moved west of the Nantahala Mountains onto lands within the Hiwassee system. In 1838, United States military forces under the command of General Winfield Scott established Fort Butler on a bluff overlooking the river at present-day Murphy to implement the forced removal of most Cherokees to lands in Oklahoma. Murphy, which is bisected by the Hiwassee and Valley rivers, was established in 1840.

Today nearly 30,000 people live in the Hiwassee basin within North Carolina. They utilize the Hiwassee's abundant resources in numerous ways, including boating, fishing and other recreational activities on the lakes and rivers. Forrest Lockaby is a local

HIWASSEE RIVER BASIN

KEN TAYLOR



fly fisherman who has been fishing the Hiwassee below Chatuge Lake dam in Clay County for nearly 30 years. He prefers "redhead" flies of the stonefly or caddis type that he ties Palmer style.

"The best stretch of fishing is from about the third week in February into May," he said. "I catch mostly rainbow trout but also some brown. I've seen browns that go 20 inches."

The Hiwassee system has a remarkable wood duck population. According to N.C. Wildlife Resources Commission management technician David Allen, more wood ducks are banded there in some years than any other place in the state. River otters were successfully reintroduced in 1995. And numerous wildlife observers feel that it is only a matter of time before bald eagle nest sites will be discovered along the Hiwassee. The eagles are now spotted year-round and the impoundments have created suitable nesting sites throughout the region.

The North Carolina Natural Heritage Program lists various rare aquatic species in the Hiwassee system. Three of these are freshwater mussels, one of which (the little-wing pearly mussel) is federally endangered. Two crayfish species (the Hiwassee and Parrish) are endemic to the Hiwassee system; that is, they are found there and no other place in the world. Other rare species include three fish (the sauger and the tangerine and olive darters), a turtle (the loggerhead or stripeneck musk), and an aquatic salamander (the hellbender).

Many biologists note that the Hiwassee system is unique because though physiographically located in the Blue Ridge Province, it hosts plants and animals usually associated with the eastern part of the state.

"[This region] is generally thought to be much more similar to the Piedmont and perhaps Coastal Plain provinces than to the more mountainous areas within which its headwaters are located," said Western Carolina University biologist J. Dan Pittillo. "Some of the Piedmont species you don't anticipate in the mountains pop up in the Hiwassee system. The elevation is low and the rivers are broad-valleyed.

"It's also located in a region that's fairly remote from research facilities and the state agencies that monitor research. I am certain there are exciting things in the Hiwassee system yet to be discovered. It's an area that's ripe for review."—*George Ellison*

HIWASSEE RIVER BASIN FACTS

Mississippi drainage

Size of N.C. watershed: 640 square miles

Total streams and rivers: 986 miles

Major tributaries: Hiwassee, Valley and Nottely rivers

Municipalities: 3

Population: 26,723 (1990)

Major land use: Forest

States flow through: N.C., Ga., Tenn.

Falling Waters

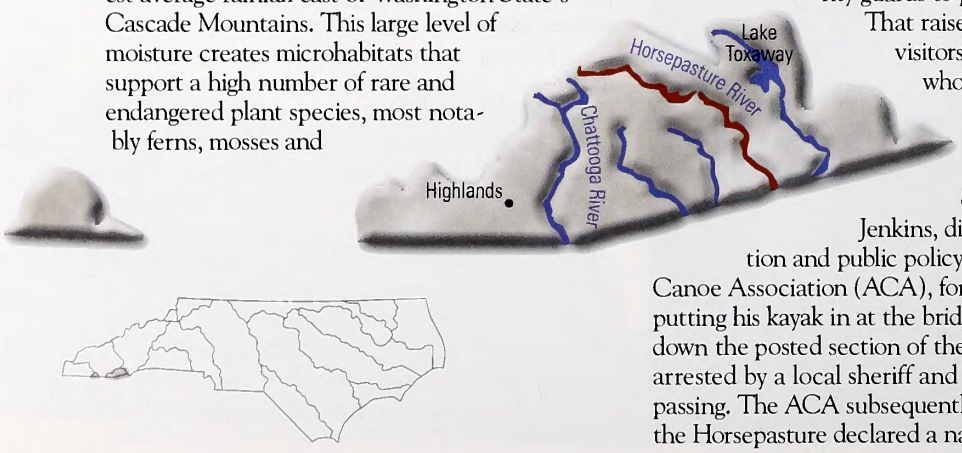
Horsepasture—could they possibly have found a less compelling name for this river? Could they not have called it Cataract Creek, Falls River or the Little Niagara? No doubt, there is a pasture somewhere along the Horsepasture River, as there is on every river in this state. But to name it that is like focusing on Nicole Kidman's choice of footwear or exclaiming over the gift shop at the edge of the Grand Canyon. The Horsepasture is about waterfalls—many waterfalls, big waterfalls, perhaps the most spectacular chain of waterfalls in the eastern United States.

The Horsepasture rises in southwestern Transylvania County and tumbles 2,000 feet down the Blue Ridge Escarpment before emptying into South Carolina's Lake Jocassee. Together with the nearby Toxaway, Thompson and Whitewater rivers, it forms one of two subbasins of the Savannah River. In 1985, North Carolina declared a 4.5 mile stretch of the Horsepasture as a State Natural and Scenic River, and Congress followed the next year with National Wild and Scenic River designation. Those actions were taken with the intention of blocking a planned hydroelectric development on the Horsepasture, but the watershed clearly deserves recognition—and protection—in its own right.

The upper Savannah watershed receives an average of 100 inches of rain per year, the highest average rainfall east of Washington State's Cascade Mountains. This large level of moisture creates microhabitats that support a high number of rare and endangered plant species, most notably ferns, mosses and liverworts. One of the most celebrated plants is the Oconee bells, a flowering beauty whose nearest relatives are found in Japan and China. The Savannah River subbasin also contains seven species of fish and crayfish that are listed by North Carolina as either Threatened, Endangered, Special Concern or Significantly Rare. And entomologists recently identified several species of macroinvertebrates that are endemic to this watershed. But it is the waterfalls that generate the most excitement.

The Horsepasture has five named waterfalls within a two-mile stretch, each one of which is worth a calendar cover. Drift Falls skims over undulating bedrock at a 45-degree angle, creating a waterslide tailor-made for daredevils. Turtleback Falls runs short and wide, a heartstopping drop into a deep plunge pool. Just downstream lies Rainbow Falls, the king of them all at 150 feet in height. On any given summer day, this stretch of the Horsepasture will be crowded with sightseers and swimmers. But allowing the public safe and legal access to the river has become a problem. In fact, it is now the central issue surrounding the Horsepasture.

The upper Savannah watershed is steep, remote and largely devoid of roads. Sightseers have traditionally accessed the waterfalls along the Horsepasture by parking near the N.C. 281 bridge crossing and walking down to the river. That land was long owned by Duke Power Co. (now Duke Energy) which tolerated public use. But in 1998, Duke sold the land and the new owner posted "No Trespassing" signs along the road and river and hired security guards to patrol the area. That raised the ire of regular visitors, including some who think the public should at least be allowed passage down the river channel. David Jenkins, director of conservation and public policy for the American Canoe Association (ACA), forced the issue by putting his kayak in at the bridge and paddling down the posted section of the river. Jenkins was arrested by a local sheriff and ticketed for trespassing. The ACA subsequently filed suit to have the Horsepasture declared a navigable river. The



SAVANNAH RIVER BASIN **FACTS**

Atlantic drainage

Size of N.C. watershed: 151 square miles

Total streams and rivers: 209 miles

Major tributaries: Chattooga, Toxaway, Horsepasture, Thompson and Whitewater rivers

Municipalities: 1

Population: 3,950 (1990)

Major land use: Forest

States flow through: N.C., S.C., Ga.

***Plummeting off the** Blue Ridge Escarpment, Rainbow Falls is the largest of five major waterfalls within a two-mile stretch on the Horsepasture River. One hundred inches of precipitation each year makes the region drained by the river one of the wettest in the country.*

KEN TAYLOR

status of that suit is still unresolved.

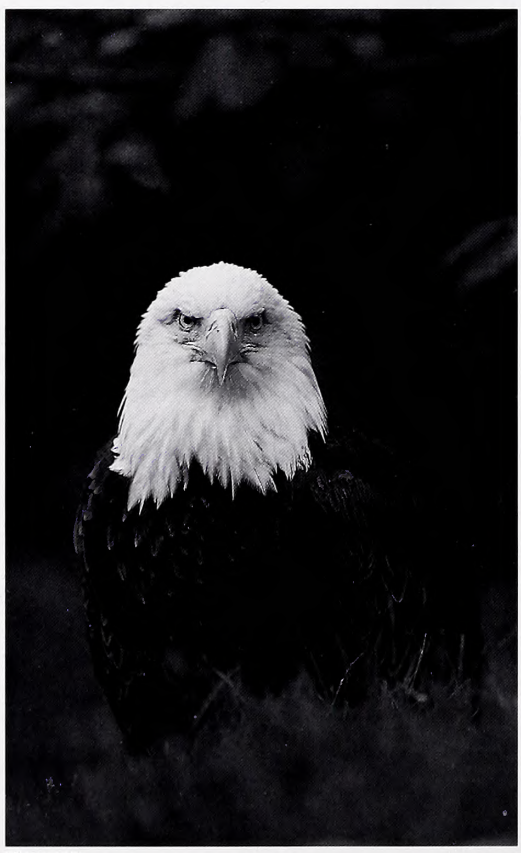
The U.S. Forest Service and the State of North Carolina both own large amounts of land in the watershed, including game lands that are used for hunting. However, there are no formal parking areas or public facilities, and the trails through the area could easily become overused.

In 1998, Gov. Jim Hunt signed a bill to purchase 9,641 acres of property in the Savannah River Basin. Part of the property will form the Gorges State Park, the first state park west of Asheville, featuring 30 sites recognized as significant by the Natural Heritage Program and 13 waterfalls. Another portion will be managed by the N.C. Wildlife Resources Commission as a game land.—*John Manuel*

The FRENCH BROAD: on the Road to Wellville

written by Bland Simpson ©1999

"Too thick to drink, too thin to plow." That's how the people once referred to the sediment-laden French Broad River. But that was then, and what is now is a river that has taken the first steps back to good health. Although the end of the road is not yet in sight, most people think the journey is easier than it has been in a while. With a long and magnificent history, the best is yet to come for this westward-flowing mountain river.



WILLIAM S. LEA

The bald eagle *flies high over the French Broad river basin, one of the many places where the once-endangered raptor is found today.*

A few of the springs have gone completely; many of the streams have dwindled irreparably; most of the rivers have diminished. They need, like the people of the region, our concern and respect.

—Wilma Dykeman,
The French Broad, *1955*

■ Court House Falls

This is a grand place to start a river, I thought, gazing at Court House Falls in Transylvania County, high upon a south slope of the Blue Ridge below a ragged black rock called the Devil's Courthouse. Within the mountainside, though, the falls sat low down, spilling away into an elongated oval granite bowl it long ago made for itself.

No one but our party—the Queens, lawyer Frank and his little girl Grace Ellen; architect Joe Sam and his boy Charlie; rangy Carolina student Christopher Holt; and my wife, Ann, daughter Cary and I—was there for a spell that late May Saturday noontide. Presently more pilgrims wandered in, drawn as we were to this charmed font.

A light mist was in the air from all the creek's commotion. The water's veil spread from a little over a foot, where it started its 50-foot fall, to a broad white band of 8 feet where it hit its deep pool, and the steady pouring, splashing noise of the onrushing waters of Court House Falls and Creek filled the long bowl. Below the pool was a small gravel wash on the far bank, and an emerald moss lay smoothly upon the wall of rock rising above as if it had been painted there. The noon sun fell like a shaft down into this deep basin, lighting up the pool, the great rock walls, the small lavender moths that were flitting about. Hemlock sentinels towered above the falls, lofty but with what seemed scant purchase at the edgy tops of the high walls. Rhododendrons flowered above us,

FRENCH BROAD RIVER BASIN

ANN CARY SIMPSON

Court House Falls

FRENCH BROAD RIVER BASIN **FACTS**

Size of watershed: 2,830 square miles

Total streams and rivers: 4,113 miles

Major tributaries: French Broad (including Mills and Davidson rivers), Pigeon and Nolichucky rivers

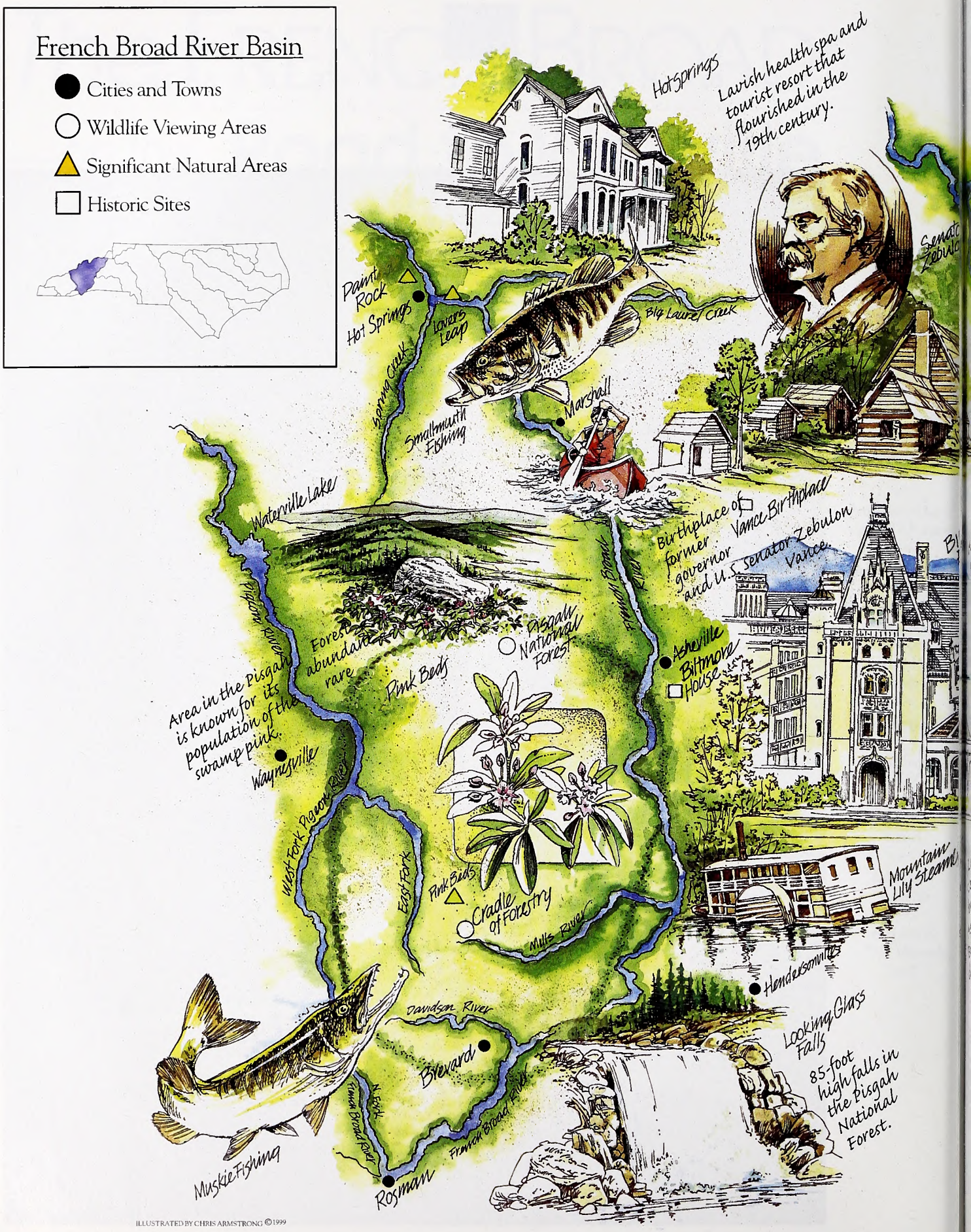
Municipalities: 24

Population: 358,000 (1990)

Major land use: Forest

Mississippi drainage

States flow through: N.C., Tenn.



ILLUSTRATED BY CHRIS ARMSTRONG ©1999

America's largest privately owned home was completed in 1895.

Late 19th-century steamboat connecting Asheville and Brevard was destroyed by floodwaters.

and littering the stream and its narrow banks were scores of small blossoms like bits of waxy linen.

From here the waters of Court House Creek flew into a fluted chute and fell away, racing over the boulder field of former falls, on down the mountain to the North Fork, which meets the West Fork a few miles southwest of the tiny town of Rosman. A mile below and east of Rosman, the Middle and East forks join in. The stream gentles along a broad farm valley until it is through Asheville and starts racing again, on down through a right tolerable gorge, and passes Paint Rock into the state of Tennessee.

Till it meets up with the Holston at Knoxville and the two become one as the Tennessee, this stream is the French Broad. The Cherokee called it *Long Man, the River*, and all the streams he pulled in—among them the Davidson and the Mills and the Swannanoa and the Nolichucky and the Pigeon rivers—were his *Chattering Children*. This is the bonafide French Broad River, the first of the wide streams or "broads" the old-time huntsmen met that flowed away from the ocean they or their parents had crossed and ran instead north and west into what was then French territory, on to the mighty Mississippi, where the waters of the *Long Man* at last met venerable Old Man River himself.

So let it start then, at least in part, at a place called Court House Falls, where the real sweet honey in the rock is water, and at this source—emblem even—of a mountain river let a judgment be entered in favor of its purity, its vitality, its force.

Upriver Float

At the confluence of North and West forks sits the hut and rainbow-colored yard of Headwaters Outfitters. A bit downriver, the outfitters' boat-filled trailer was pulled into Rosman's Champion Park, a half-acre of easy-sloping lawn by the water with some sycamore shade off to the side. Fifteen people were getting onto the French Broad in kayaks; with our two green canoes and one white, we added half that again. It was a hot afternoon and seemed busy in Rosman, the little upriver town with the gigantic school-spirit tigerpaw tracks down its main street. It was a good day to spend living on river time.

After a couple of light rapids and riffles, we glided along at a lazy pace for quite a ways before the next batch of tumbles. By then Ann and I had the two little girls in the white canoe with us, and we enjoyed these occasional jogs in the river.

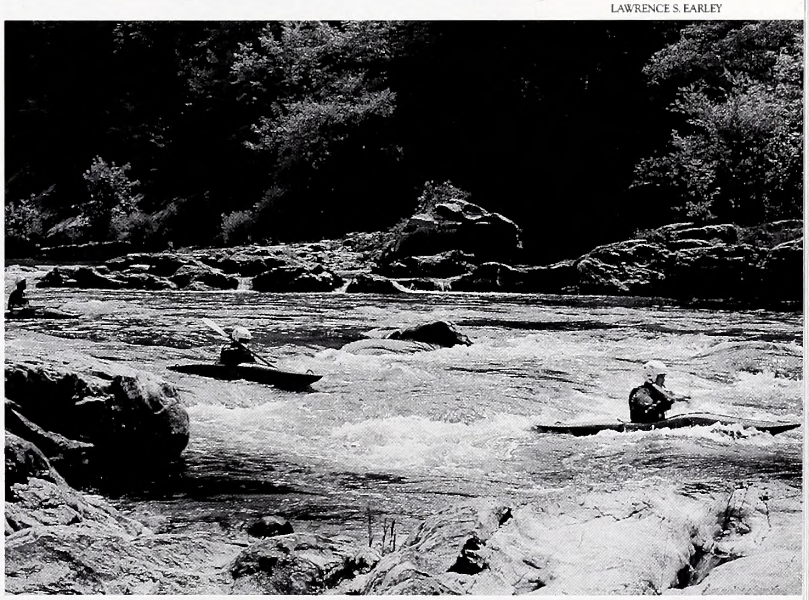
Along the riverbanks were cascades of pink roses, blackberry blossoms, now and again a fallen-over willow. Cary named one bankside feature—her favorite of the day—"the Elephant Log," for it lay in the water with an empty knothole for a pachyderm's eye and a branch for a trunk aiming up at the big blue Transylvania mountain-valley sky. While we were seeing elephants, Joe Sam and Charlie Queen were watching redwing blackbirds, catbirds, swallows in the riverbanks, a little green heron. Rounding one bend, they came upon a groundhog just standing there watching them.

In deeper pools we spotted wary fish swimming quickly, clearing out of our way. The whole French Broad is now a celebrated muskie fishery, and trout anglers toast such coldwater tributaries as the Davidson. We passed the outfitters' party of boaters, already landed, and where we pulled over to take out farther downstream, a man and woman were fishing from the bridge above. Just as we were stepping from the white canoe she shrieked, "I got one, I got one!" and he helped her reel it in, the both of them surprised, their catch on the shortening line glistening like silver in the summer sun.

In Asheville

"Who killed the French Broad?" river chronicler Wilma Dykeman asked in her 1955 Rivers-of-America series book *The French Broad*. It was a powerfully good question back when people said of the then-degraded river such things as, "You can smell it way before you can see it." They derisively termed it "too thick to drink, too thin to plow."

LAWRENCE S. EARLEY



***Kayakers** enjoy some white-knuckle excitement at "The Ledges," just above Hot Springs.*

Nowadays, the song one hears sung all up and down the valley is one river's air of rejuvenation, and the apt question nowadays is, "Who's reviving the French Broad, and how?"

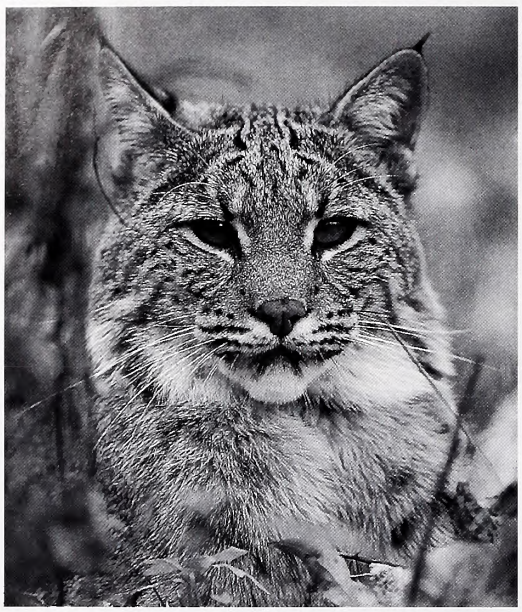
Look to Asheville for a large part of the answer.

"There's a lot of really good things happening with the French Broad," Ginny Lindsey said to me last summer, and, if anything, her cheerful comment was really a remarkable understatement. Lindsey works with the Clean Water Fund's Asheville office which in 1992 examined the permitted discharges into the river.

"I'm happy to say that some of the worst problems at that time have been cleaned up and are gone," she said. One of them was the General Electric facility, a Superfund site that was discharging out of a wastewater treatment pond. Now it's putting its waste into the city sewer, and a nearby creek, Bat Fork Creek, is starting to come back to life. It was considered one of North Carolina's dead creeks a few years ago. "It's not

***Early morning** walkers enjoy the French Broad River Park (right) in Asheville, an award-winning project of RiverLink. The Pigeon River, the French Broad and many other rivers and streams in the river basin drain a steep, mountainous terrain that is home to bobcats (below) and other wildlife.*

WILLIAM S. LEA



LAWRENCE S. EARLEY

KEN TAYLOR

***Asheville's RiverLink has** been a strong force behind the revival of the French Broad. Its board gathered at the French Broad River Park for this photo. From left are: Karen Cragnolin, director; Rick Maas, UNC-Asheville; Dave Tomsky, The Grove Park Inn Resort; Fritz Mueller, Cross Creek Foundation; Linda K. Taylor, volunteer; Gary Cowan, Asheville Track Club; Doug Wilson, McGuire, Wood and Bissette, PA; and volunteers Marylyn Seyler, David Cudlip and James E. Brazell.*

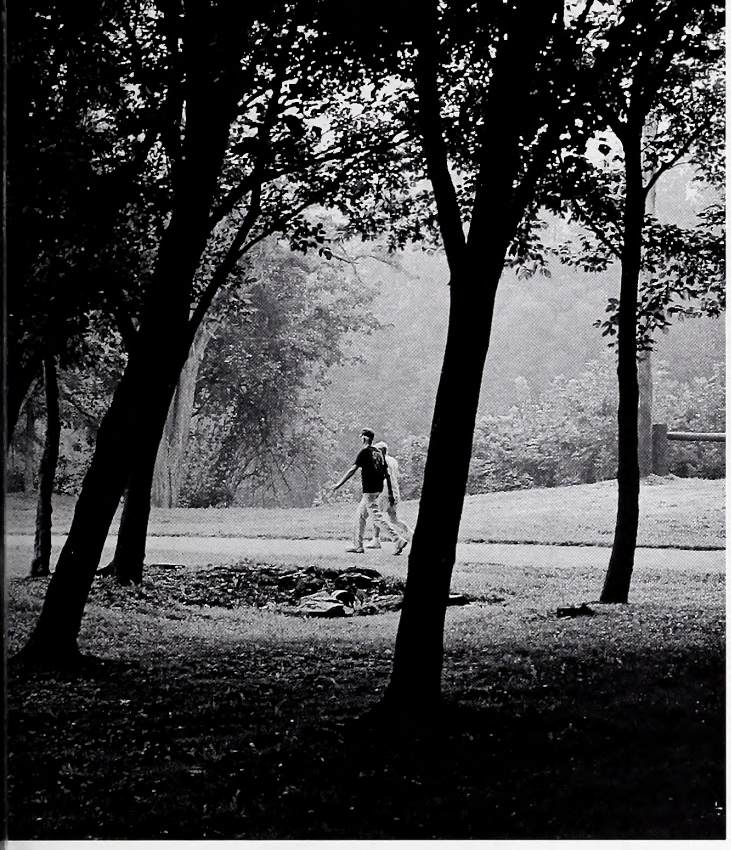
a pristine stream by any means, but it's definitely improved," Lindsey said.

Lindsey also offered a salute to the next river basin west, the Pigeon, which flows into the French Broad on up in Tennessee and whose paper mill waste has long been an open wound in Tennessee-North Carolina relations.

"On the Pigeon River," she said, "there you have the Champion Plant, now Blue Ridge Paper. We led the environmental community in rallying support behind the workers in buying that mill. Two years ago the wastewater treatment permit was really tightened up, and I think it has made a world of difference on the river. It's looking much better."

The 1970 federal Clean Water Act has helped enormously in the renovation of the French Broad. So has a concerted joint effort begun in the late 1970s by the Land-of-Sky Regional Council and the Tennessee Valley Authority to establish river access points. And so, too, has the coming together —over many years, since before the American Bicentennial—of legions of representatives from a wide variety of Asheville and Buncombe County's civil, nonprofit and academic institutions (such as the Land-of-Sky Council, the City of Asheville, Biltmore Estate, TVA, UNC-Asheville and Warren Wilson College) as well as from businesses. Working through the French Broad Riverfront Planning Committee and its successor, RiverLink, their purpose has been nothing less than making "French Broad revitalization a documented goal of all Asheville citizens."

The Riverfront Plan, a detailed and intriguing design scheme for a French Broad makeover, appeared in the spring of 1989 with a profusion of illustrations for gateways, greenways, water-



KEN TAYLOR

***Along the** Swannanoa River, a tributary to the French Broad, Biltmore Estate stands in silhouette against the night sky.*

ways, parkways, bikeways—a proud statement that the community was now bound to turn the river all ways but loose. RiverLink kept the process going in 1991 with the publication of Asheville Riverfront Open Space Design Guidelines and a program based on it.

Now the first of the future—French Broad River Park, just off Amboy Road at a northward curve in the river—has arrived, well stocked with a picnic pavilion, enhanced wetlands, observation decks, a restroom, native wildflower beds, picnic tables, benches and grills and more than a half-mile of paved greenway trails. When Ann and Cary and I looked in on the park late one Sunday afternoon last May, children were racing around on bicycles, and there were in-line skaters, older couples walking and a number of paddlers taking out canoes. One man said his trio had just made the quiet-water run from Bent Creek Park, 12 miles upriver, in about two and a half hours. "There's a fair bit of road noise," he told me of the run, "but not much development, and a real nice view of Biltmore."

For making good on this park, RiverLink won a Gold Award in 1997 from the American Rivers National Urban Hometown River Program. The award's citation states: "Today the river is viewed as a community healer that unites the community as a place where people can live, work and play."

Leading the RiverLink charge is Karen Cragnolin, an attorney who moved to Asheville in the 1980s and went to the chamber of commerce looking to get involved with her new community. "They said, 'We're trying to do something with our river,' and I said, 'I didn't know you had one.' I drove down Patton Avenue and spent the rest of the day trying to get off the bridge to the river.

"With a hotel coming on the Biltmore Estate, we see more and more people seeing this river," she said. "We put junkyards and landfills on the river before, but we're not doing that anymore—we're saying this is a place where people really want to be."

And there they are. RiverLink stages dozens of events every year to raise money and French Broad consciousness—among them sunset cruises, a day at the races, an anything-that-floats parade, and a tour of artists' studios in the river district that draws 10,000 people. Even a mythical French Broad River Yacht Club has come into being, its membership open to anyone who has ever floated a boat on the river, and an outfitter named Southern Waterways has just enjoyed its eighth season of showing folks the new French Broad, promoting "quiet-water river trips" from a 3-acre site between Hominy Creek and the Asheville Motor Speedway.

Race track?

A community rift developed recently when RiverLink purchased the popular Amboy Road riverside auto-racing track, with plans for the city of Asheville to convert the site into more greenway and carry on with the plan. The notion in some local quarters was that this move constituted a class-war between environmental elitists and salt-of-the-earth hot-rod aficionados, but Cragnolin doesn't hold with that.

"The newspaper got into promoting the speedway as a class issue," she said. "The speedway is in the middle of the city, surrounded by public housing

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In July 1916, *the French Broad overran its banks and flooded downtown Asheville, leaving much of the train station under water.*

—to me it was an economic justice issue, a clean water issue. I absolutely love going to French Broad River Park and seeing the range of people, young people, old people, people in wheelchairs, white and black people . . . . It's become a place where people have weddings, birthdays, family reunions. That's my favorite place. To see the transformation—it was a landfill—is just phenomenal!"

An equally valuable phenomenon in the valley is the monitoring activity RiverLink has brought to bear on the French Broad. It funds a Volunteer Water Information Network (VWIN), perhaps the largest citizen-based water quality monitoring program in North Carolina. The state and local regional water authority has made use of RiverLink VWIN data to help identify a new water source for Asheville's drinking water that was to be operational in July.

Another ally in the regional revamping effort is Becky Rideout of the Land-of-Sky Regional Council. Concern for the watershed brought her home from South Carolina a little over a year and a half ago, and she now coordinates clean-water efforts throughout the valley.

"There's still room for improvement," she said. "The area's developing very quickly, so there's a strong need to take protective measures to restore the river."

These measures include the protection and restoration of the French Broad's streamside buffers. In some places, where buffers have been removed, the group has found severe streambank erosion.

"But the truth of the matter is the buffer along the French Broad River is the last line of defense," Rideout said. "We need to work on the tributaries. In Henderson County, we've got projects on the Mills River, the prime drinking water source for Hendersonville, and about to be for Asheville. On Mud Creek, Ross Creek, Newfound Creek in Buncombe, the Ivy River in Madison—all these projects are focused on tackling non-point source pollution."

She admits that restoring riparian buffers is only one way to protect the river's water quality. Controlling storm-water run-off is important, and there are other things that can be done as well.

She paused a moment, reflecting upon her family and an icon from her youth. "My grandmother was born on the French Broad, in Alexander. She always had a copy of Wilma Dykeman's *The French Broad River* on a table by her easy chair. As I grew up, it's something that I always noticed there, and it really came to mean something to me when I got the opportunity to move home to western North Carolina and to work on the French Broad River.

"Coming back as I drove across it, I said, 'That's gonna be *my* river!'"

The Gorge

Below Asheville, the French Broad leaves its high, flat quiet-water self behind and tumbles down a broad-shouldered, rocky-bluffed gorge—past the towns of Alexander, Marshall, Barnard and Hot Springs—for 43 miles to Paint Rock at the Tennessee line. Over that course, it falls more than 700 feet.

Tahkeyostee, the Cherokee named the Long Man's rapids here: *Where they race.*

This may not be Meryl Streep's "The River Wild," but it's a stretch of river that's wild enough for "whitewatering" to have become the main economy of Madison County. There are now five boating and rafting enterprises between Marshall and Hot Springs; the Madison County planner, Glen Goodrich, is a whitewater enthusiast; and

Daniel Gallagher, an outfitter, is head of the Hot Springs Tourism Association.

Gorge-coursers who have come into this territory more recently than the Cherokee have also left a cascade of names for the river rocks and forms they found along the way: the *Maze*, with its myriad openings and its many dead ends; the *Big Pillow*; the *Ledges*; *Rebar Rapid*, with its iron-bar relicts of the dam that once powered Stackhouse but that the great French Broad flood of 1916 knocked out; *Needle Rock*; and the *Frank Bell Rapids*, named in honor of a legendary camp leader and river-runner.

There are nine rapids to be dealt with in the 8-mile section of river—the French Broad's steepest—between Barnard and Hot Springs. On Thursday, Sept. 4th, 1997, Brevard College professor and vice president Windy Gordon was dealing with them all. Later, in his log, he would coolly assay the *Ledges* as "a 500-yard rush through ledges and waves that focuses your attention and elevates your heart rate."

Gordon, an accomplished paddler, was focused indeed. He was on day 6 of a three-month trip leading a small group of Brevard students on an experiential semester down the French Broad to the Tennessee, the Mississippi, and, ultimately, to the Gulf of Mexico. The float was already known as "The Voice of the Rivers," and its participants would meet thousands of people through public programs they gave along the way. It was so successful that Brevard has made "The Voice of the Rivers" an ongoing part of its curriculum, with a spring '99 float through South Carolina accomplished and a future trek planned for the Savannah River system. Its purpose is to call attention to the nature, health and needs of America's watersheds.

"The French Broad is a tremendous asset which links a broad span of western North Carolina, from southern Transylvania County all the way up to northern Madison County," Gordon said. "It has become a major recreational resource.

"The quality of the river in both developed and nondeveloped sections, I think, is steadily improving—an actual improvement in water quality, and, perhaps, more important, a *perceived* improvement. As people believe it's an asset that has quality, they want to protect it. When it was perceived as a lost cause, it was treated as a lost cause."

No such treatment now. Here in the gorge, RiverLink recently built Ledges Whitewater Park, a canoe and kayak practice course, funded by the state Division of Water Resources. "Basically," said RiverLink's Karen Cragnolin, "we did it with a $30,000 grant and a lot of volunteers, and NationsBank is funding a program using Ledges Park. They're saying 'Let's use rivers, canoeing and kayaking to get inner-city kids interested in nature!'"

Marvel at the current emphasis on boating and floating downstream, and recall too that in the last century, most of the French Broad's traffic was not so much on as alongside it, and was bound upriver instead of down. By the 1830s and 1840s a rolling, roiling stream of livestock was boiling up out of the grasslands and pasturelands of the lower French Broad in Tennessee. The drovers were using the river and its gorge as the best and easiest way to South Carolina, to slaughterhouses in Spartanburg and markets in Charleston.

Every autumn, pork and beef moved up the river on the hoof, mules, too, turkeys in flocks of 500—even a drove of 400 ducks caught the eye of an 1857 Warm Springs visitor. Tennessee hogs were shuffling up the gorge at a rate of 150,000 a year and more. Institutions called "stands"—19th-century inn-and-stockyard hostelries—grew up at points along the river, and the biggest of these was the one in north Buncombe run by James Mitchell Alexander.

Today the place is known as the town of Alexander, but then, according to author Dykeman, Alexander's stand was "known from Cincinnati to Charleston as a summer resort, [and] it came into its own during the fall drives when ten or

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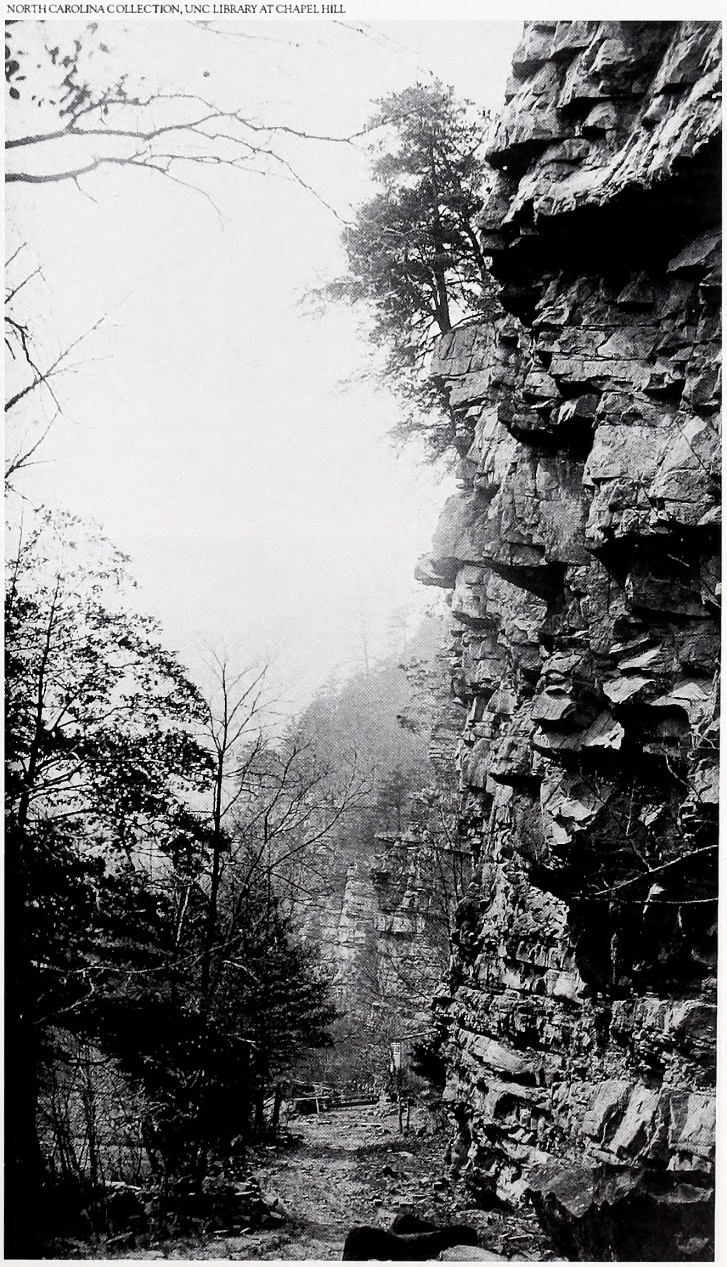

***Paint Rock,** a dramatic rock formation located near the Tennessee border, is a well-known landmark on the French Broad River.*

a dozen droves might be stopped there for a single night." That might mean as many as 100 men and 10,000 hogs.

Two generations later—long after the coming of the railroad in the 1880s ended the livestock tides—moonshine culture got strong in the French Broad valley, and Dykeman captured the spirit of the Prohibition age as well when she interviewed a lawman ironically named Jesse James Bailey. He was the sheriff of Madison County from 1920 to 1922, with Marshall as its county seat.

"Bloody Madison, you know," Bailey told her. "Folks say it's the town that's a block wide, a mile long, sky high and hell deep."

The drovers, the bootleggers and the lawmen —these and their times are faded and storied now. Just below the Buncombe-Madison line, in the summertime at Walnut Island park, I watched families picnic, boys toss rocks in the river, girls slip and slide down a small chute the river has worn through a graywhite granite reef, a man and his son walk across the wide shallows to the far shore and then back again, and dogs run free. There was charcoal smoke and Spanish in the air, no shortage of either. Downriver, just a few miles above Marshall, upon a long rocky island in the middle of the French Broad sat a porcelain commode, flanked by North Carolina and American flags flapping in the breeze.

Something surreal here, I thought. And newly real as well—the new coin of the realm hereabouts was neither porkshoulders nor popskull, but was measured rather in gaily colored rafts and kayaks scooting, careening and slip-sliding merrily down a French Broad River considerably cleaner than it has been at anytime since those drovers and bootleggers left the stage.

La vida es sueno, they say in Spanish: *Life is a dream.* Here the dream about the river, the revivified French Broad, really does seem to be coming true.

Es verdad.

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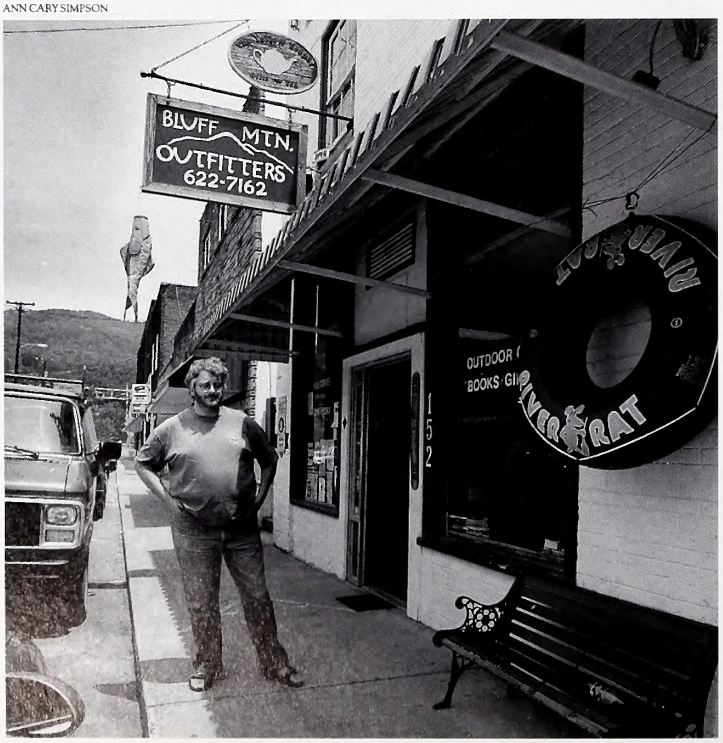
***Hot Springs** was once a fashionable destination for people who wanted to take the healthful spring waters. Daniel Gallagher (below) is co-owner of Bluff Mountain Outfitters in Hot Springs.*

ANN CARY SIMPSON



Hot Springs

If you light on the U.S. 25 bridge over the French Broad at Hot Springs and look south, you stand to take in a good deal. Upriver there to your left on the east bank is good old craggy Lover's Leap Mountain, and the river itself is coming vigorously at you in just about the last of its rapid fall and run. Your perch is a major mountain crossroads of sport, for here the Appalachian Trail bridges the French Broad, and here in this little corner of Carolina, paddle culture meets the boot world in spades.

Hot Springs has only been hot for a little over a century. Before that, the waters and town were called Warm Springs, and were widely reputed to be restorative enough, though more for their mineral qualities than their heat. What warmth there was was due not to geothermal activity but to friction. Some low streams of the French Broad, apparently siphoned off upriver, push briskly through narrow subterranean fissures and heat themselves —if mildly—during their clandestine transits. But when the grand resort hotel burned in the mid-1880s, the building of its successor occasioned an upward reappraisal of the springs' temperature as well as a felicitous commercial appeal of a name change. Good became better as Warm became Hot.

The valley of the French Broad had long sought to—and in fact did—make wealth out of health.

LAWRENCE S. EARLEY

***In a small-town** rite of summer, a young girl watches her older brother walk the railroad tracks in downtown Marshall, with the cupola of the county courthouse visible in the background.*

"For several decades before the Civil War," wrote the great American novelist Thomas Wolfe about Altamont, his fictional Asheville, "it had enjoyed the summer patronage of fashionable people from Charleston and the plantations of the hot South." They came to Flat Rock in Henderson County, "the little Charleston in the Mountains," to Asheville with all its proclaimed curative and recuperative values (Wolfe's fellow writer F. Scott Fitzgerald brought his wife Zelda to Asheville hoping to restore her health), and downriver to Hot Springs.

Though that spa-and-springs scene faded, in Hot Springs now there are still a few footprints from those old days. "Sunnybank," once a small hotel and guest house, sits on the corner of Walnut and Bridge. Though the great Mountain Park Hotel that Colonel J.H. Rumbough built in the 1880s fell to fire in the 1920s, the colonel's mansard-towered home not only stands but currently glistens, put back to right as—what else?—a bed-and-breakfast. Hot Springs just about closed up for several decades, but these days the town is on the rise, and the crossroads of sport is why.

Out on Bridge Street, the main avenue through town, we met Daniel Gallagher, who as co-owner of Bluff Mountain Outfitters was outdoors taking stock of the street. Gallagher was a big, jovial, bearded fellow, originally from Connecticut and now retired from the Air Force. This year was his third season operating a trail shop literally on The Trail itself, and, as hikers passed by with their staves—some striding, some staggering—string-band music came clawhammering boisterously out of Gallagher's store.

"Ten years ago," he said, "there was only one store open downtown. It was dead, but now it's bustling!"

While we spoke with Gallagher, a civilian cavalry of two dozen horses ambled through town. There was ample commotion about us, and it felt good to be there in this powerful confluence. Gertie's, Too, a small restaurant across the street, offered "Hiker Specials" all day long and was packed for lunch at nearly three in the afternoon.

Out on the 25 bridge, an Asian woman and a bearded man were headed south, grimly determined. A longhaired 25-year-old man, shirtless, held hands with his blonde girlfriend, both of them loping along easily in the heat. Beside a store across from the open grounds of the Hot Springs Spa were young hikers in the shade, one man in an olive-drab slouch hat, another in a khaki foreign-legion lid. Boys with red and blue bedrolls were laid out like overheated hounds, lucky to have escaped to the shade. In the river itself, people were swimming upstream of the bridge, a few with an old tire tube, one bunch with a pink float.

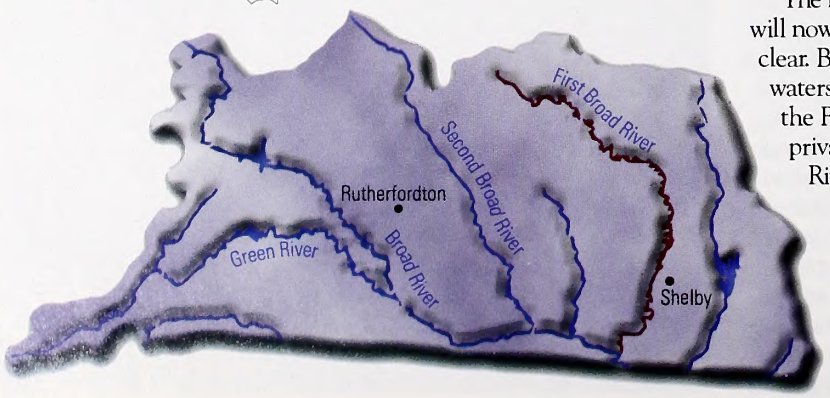
This was the French Broad today, and Wilma Dykeman who helped save it must be aware and glad that the river she described as having been "killed" 45 years ago is now not only alive, but is also getting more than a little of that good and magic quotient she once called respect. ⊠

First in Their Hearts

Drive N.C. 226 south from Marion and you will come to the mountains before the mountains. Rising like an island from the undulating surface of the western Piedmont, the South Mountains have the look of the Blue Ridge. They have peaks as high as 3,000 feet and valleys thick with rhododendron and hemlock. Tumbling down the southern flank of this range are a dozen beautiful streams—the headwaters of the First Broad River. Today, these streams run clear and clean, but it was only through the dedication of local citizens that they don't run red.

In 1998, the headwaters of the First Broad were saved from being logged through the hard work of local citizens, state officials and a national environmental group. Before that, most of the southern flank of the South Mountains—17,829 acres—was owned by a single private corporation, J.R. Rollins Inc. In 1996, Rollins sold the land to an Alabama-based investment company which, in turn, planned either to sell or timber the land for profit. With the construction of a high-volume wood chip mill 10 miles to the south, the demand for timber was particularly high.

"Had we not been able to secure it, the Rollins tract would eventually have been clear-cut all the way across," says Susie Hamrick Jones, executive director of the Foothills Conservancy, the local land trust that led the preservation effort.



The loss in natural beauty and ecological diversity from timbering this land would have been devastating. When he inventoried the Rollins tract in 1997 for the state's Natural Heritage Program, botanist Bill Moye discovered 22 species of rare plants. This led the Heritage Program to declare the tract as a nationally significant site. The watershed is also a source of drinking water for 41,000 residents of Cleveland County, and widespread logging could have threatened water quality through increased erosion.

Realizing that the sale of the land to timber interests was imminent, the South Mountains Coalition (now called the Foothills Conservancy) set out to generate local support for saving the property. Moye, a photographer as well as a botanist, produced stunning images of the several large waterfalls in the headwaters, as well as streamside vegetation. Public information sessions were held throughout the region and local legislators were encouraged to support public funding. Staff from the North Carolina chapter of The Nature Conservancy, the N.C. Wildlife Resources Commission and the Natural Heritage Program visited the region for a closer look.

The combined efforts paid off. In 1998, the N.C. General Assembly, the Clean Water Management Trust Fund, the Natural Heritage Trust Fund and the Wildlife Commission together came up with $12.35 million toward the purchase of the land. With the promise that the remaining funds would be raised, The Nature Conservancy purchased the tract for the asking price of $13.4 million. The land was transferred to the Wildlife Commission to be managed as a state game land.

The forests in the headwaters of the First Broad will now grow to maturity and the streams will run clear. But that is not the situation throughout the watershed. After leaving the state game land, the First Broad runs some 40 miles through private land before merging with the Broad River near the South Carolina line. Approximately 60 percent of the land in the larger Broad River Basin is in timber and another 20 percent in crop and pastureland. When fields are plowed and woodlands harvested, the potential for erosion increases dramatically. After a hard rain, locals say many of the streams run red

BROAD RIVER BASIN FACTS

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Atlantic drainage

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Size of N.C. watershed: 1,506 square miles

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Total streams and rivers: 1,472 miles

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Major tributaries: Green, First Broad and Second Broad rivers; Buffalo Creek

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Municipalities: 29

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Population: 169,001 (1990)

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Major land use: Forest

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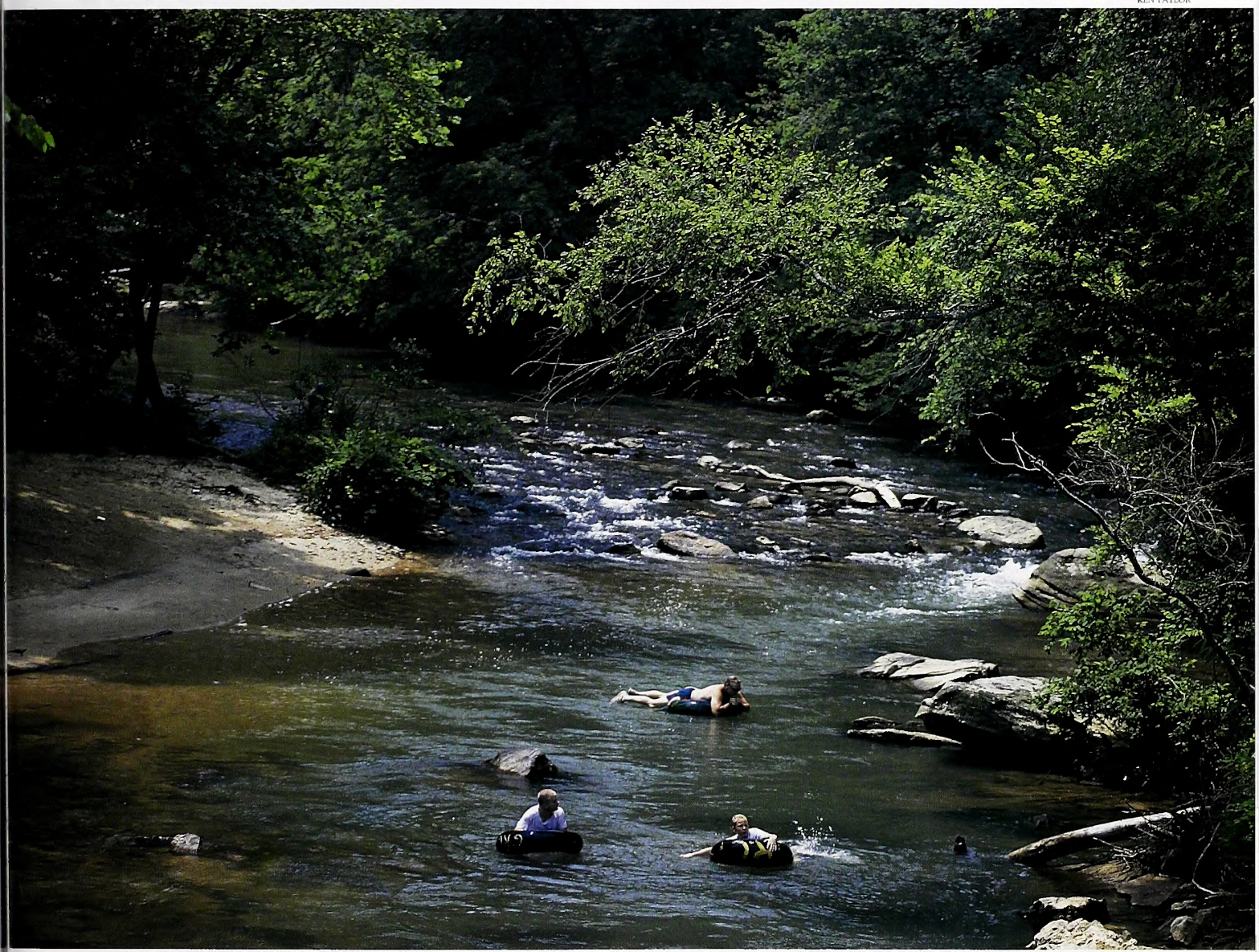
States flow through: N.C., S.C.

KEN TAYLOR



***Tubing down** the Green River in Polk County may not have been possible if not for a major conservation effort in the late 1980s. The Lake Lure Inn (shown right) is located on one of the impounded portions of the Broad River.*

from sediment washing off the hilly land. The sediment is not just unsightly, it also smothers the habitats and nesting sites of fish, freshwater mussels and macroinvertebrates. The N.C. Division of Water Quality has declared that sedimentation is prevalent throughout the basin. Until that changes, the people who love the river don't consider their job done.

"We're trying to convince farmers not to plough right up to the streambanks and to keep their cows out of the water," says Jones. "And we would like to see wider natural buffers left around all the streams. We've achieved a major victory in protecting the headwaters of the First Broad, but we don't consider our job done."—*John Manuel*

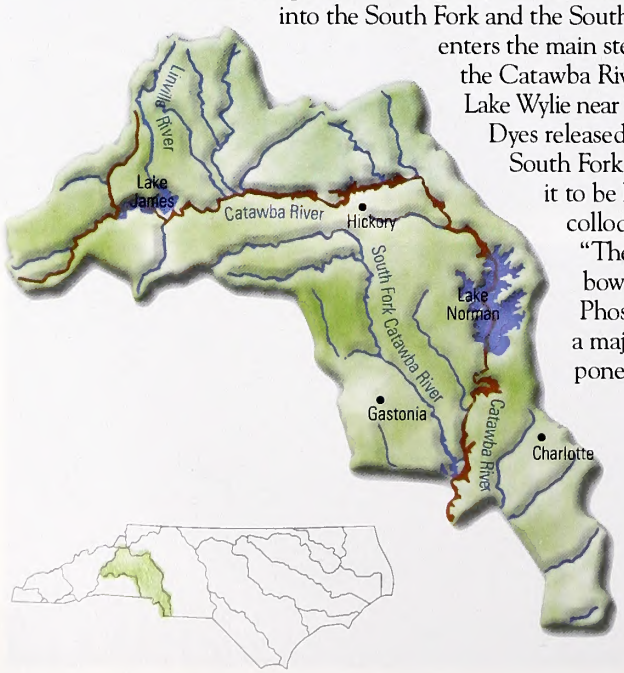
MELISSA McGAW

RIVER of Change

Variety—that's the word to describe the Catawba River on its 224-mile journey from the hills near North Carolina's Mount Mitchell to its juncture with the Wateree River in South Carolina.

Eleven dams block the Catawba's flow, seven of them in North Carolina. Only two sections of the river are still free-flowing, one in North Carolina below the Lake James Dam and one in South Carolina below the Lake Wylie Dam. Thirty miles long and with 32,000 acres of surface area, Lake Norman, just north of Charlotte, is the largest manmade body of water wholly within North Carolina. It's so large, a drop of water that enters Lake Norman above Interstate 40 could be retained for more than 200 days.

The water quality of the Catawba basin varies from place to place. The Linville River, which flows into Lake James, is one of the state's four Natural and Scenic rivers. There the water is clear and the banks are covered with dense forest. Clark Creek and the South Fork River, however, have degraded water quality. Clark Creek flows into the South Fork and the South Fork enters the main stem of the Catawba River in Lake Wylie near Gastonia. Dyes released into the South Fork cause it to be known colloquially as "The Rainbow River." Phosphorous, a major component of water quality degradation, is 15 times more abundant at the mouth of the South Fork than at the upper end of Lake Norman.



Yet efforts to protect water quality in the Catawba River are growing. A few years ago, spurred by the Lake Wylie Marine Commission and the Catawba River Corridor Study Task Force, both staffed by the Centralina Council of Governments, the Catawba River Foundation was established. In January 1998, the foundation hired Donna Lisenby as the Catawba Riverkeeper. Lisenby has organized volunteers at Lake Wylie into a citizens force to monitor water quality, and she plans to expand the day-to-day operation of her program throughout the basin in the next few years.

Mecklenburg County recently started S.W.I.M. —Surface Water Improvement Management— a program many hope will be a model for other jurisdictions. The goal of S.W.I.M. is to improve water quality in Mecklenburg County's 3,000 miles of streams to a level suitable for prolonged human contact (wading, fishing, swimming). Only 15 percent of the county's streams now meet that standard. Elements of S.W.I.M. include erosion control, vegetative buffers and better monitoring and enforcement.

An additional effort to protect the Catawba River and its value is the recent protection of undeveloped land on the west side of Mountain Island Lake in Lincoln and Gaston counties. Funds came in part from the North Carolina Clean Water Management Trust Fund. In combination with undeveloped land held by Duke Energy and Mecklenburg County on the east side of Mountain Island Lake, the reserved land protects water supplies for hundreds of thousands of people and provides habitat for deer, wild turkeys, eagles, beavers and ospreys, among many other wildlife species.

Land uses along the river also vary. Major areas of the Lake James shoreline are forested. There are state parks on Lake James and Lake Norman. County parks are scattered along the length of the river and thousands of acres of woodlots dot the watershed. But farms, often dairy farms, also abut the Catawba and runoff from agricultural uses is a major source of fecal coliform in the river.

The most rapidly increasing land use along the entire length of the Catawba River is urbanization. More people live in the Catawba River Basin than

CATAWBA RIVER BASIN FACTS

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Atlantic drainage

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Size of N.C. watershed: 3,279 square miles

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Total streams and rivers: 3,083 miles (free-flowing)

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Major tributaries: Catawba, South Fork Catawba, Johns and Linville rivers

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Municipalities: 38

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Population: 1,033,347 (1990)

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Major land use: Forest

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States flow through: N.C., S.C.

CATAWBA RIVER BASIN

KEN TAYLOR

Once a free-flowing river, much of the Catawba River has been impounded to provide the fast-growing Piedmont region with drinking water, electric power and recreation. Lake James (above) is just one of seven impoundments of the Catawba River in North Carolina.

in any other state river basin. In the decade of the 1990s, the built-up shoreline increased 35 percent. In the next 20 years, open land is expected to disappear at the rate of 41 acres a day. As part of its stewardship, Duke Energy must license piers and docks on the Catawba River. In 1998, 1,590 new pier permits were issued, an increase of 77 percent over 1997. There are more single-family homes, more condominiums, more golf courses, more everything—except open land.

People use the river in a variety of ways. Like other rivers in the state, the Catawba is a source of drinking water, but large cities as well as small towns pour their treated wastes into it. Hundreds of small, private package plants treat waste from subdivisions and industries and release it into the Catawba River or its tributaries. Given the uses, we need to remember that we all live downstream.

Recreational uses of the river basin vary, too. Anglers fish for smallmouth and largemouth bass, striped bass, white bass, white and black crappie, bream and catfish—blue, flathead and channel. In isolated spots, there are also walleyes and muskellunge in the Catawba. Less sought by anglers, but providing excellent sport, are carp.

Others waterski and scoot about on jet skis. Sailboats are common on all the reservoirs, with Lake Norman and Lake Wylie prime among them. Canoes and kayaks are frequent sights, especially on the smaller reservoirs. A small number of people live on houseboats, particularly at lakes Wylie and Norman.

Indeed, whatever people seek, chances are it is found on or near the Catawba River.—*Tim Mead*

Father Yadkin

written by T. Edward Nickens ©1999

photographed by Melissa McGaw

The Yadkin-PeeDee River is the cradle of humankind in the Carolinas, where evidence of 12,000 years of existence documents the history of Native Americans in the Southeast. And though its flow is interrupted by dams today, the Yadkin River is still boisterous with the spirit of moving water. This storied Piedmont river carries in its muddy waters past injustices, a tumultuous present and a hopeful future.

***Bill Oliver**, chief archaeologist for the state of North Carolina, bends down to uncover an arrow point (bottom). For 12,000 years, Indians used stones from the Yadkin River to create tools and weapons for hunting.*

With the toe of his right shoe, Billy Oliver scrapes away leaf litter, exposing a crescent-shaped smear of bare Stanly County dirt. A flake of stone protrudes from the soil. It is sooty black, the size of a matchbox. Porphyritic rhyolite, says the chief archaeologist for the state of North Carolina, the congealed marrow of volcanic flow, curdled with flecks of feldspar and quartz. And it tells a story.

Once upon a time—or, more precisely, untold numbers of times over the last 12,000 years—a man sat here. In one hand he held a chunk of rhyolite; in the other a rounded hammerstone, the size of an orange. Carefully placing a short billet of basswood or deer antler against the rhyolite, this ancient man struck it with the hammerstone. A flake of stone chipped off the rhyolite, and another, and then another, as the stone was shaped into a spear point or arrowhead, knife blade or hide scraper.

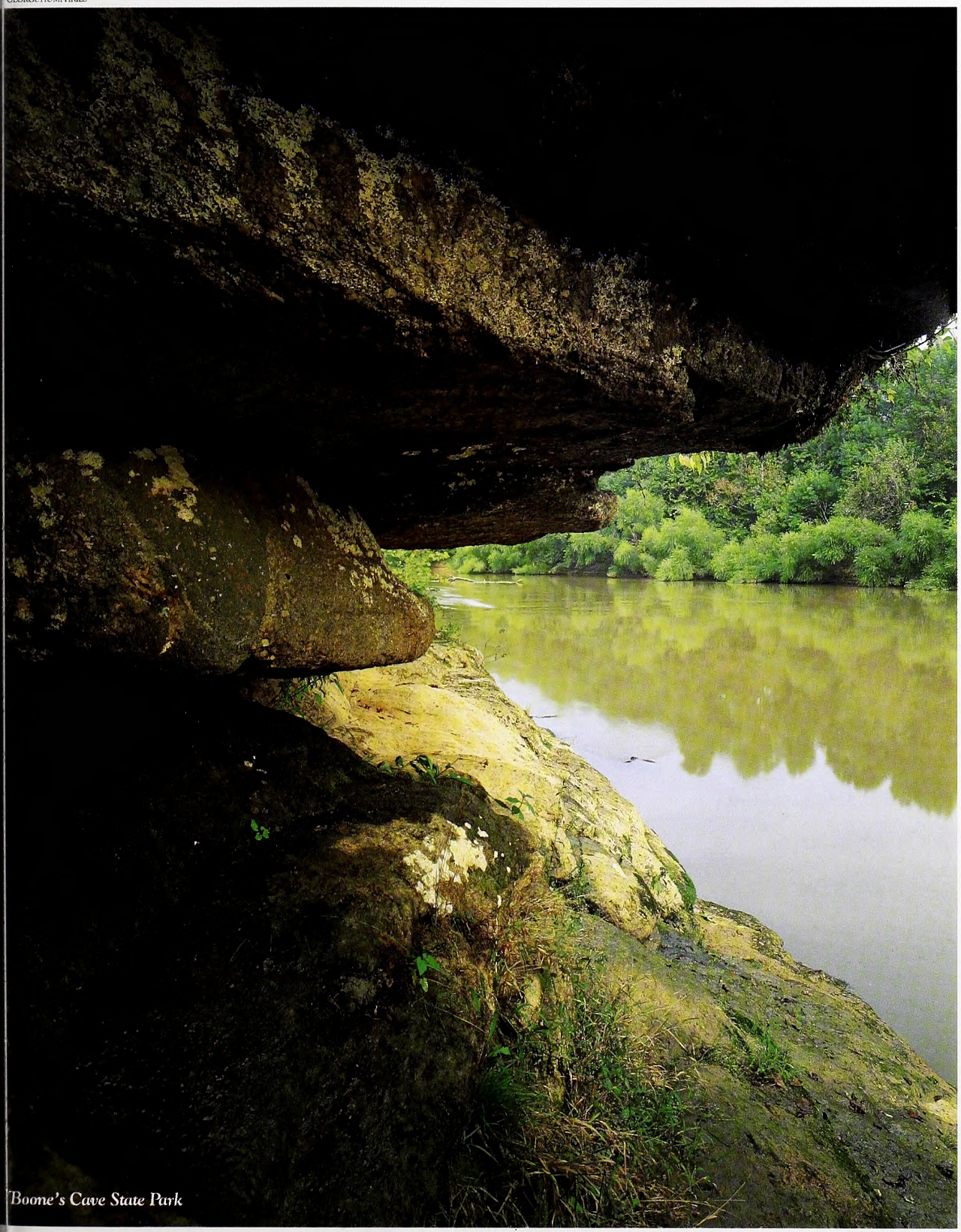
As the man worked, shards of stone piled up around his feet. When the hammerstone cracked, the man tossed it over his shoulder and reached for another. When a misplaced blow shattered a half-finished projectile, he chunked the wasted point over by the hearth and started over. This man's life depended on the precision of his stone tools. He would brook no mistakes.

"See there," Oliver says, pointing to another flake, "and there." Like eyes adjusting to darkness, I begin to see what Oliver sees. Scores of flakes litter the soil, the detritus of an ancient culture. "Now, look. There's a bi-face"—a piece of rock worked on both sides to produce an edge—"and here's a piece that's been pressure-flaked. Instead of hammering, hard pressure was used to flake off a small sliver." In effect, sharpening the blade.

Oliver and I are standing in the middle of an industrial site of mind-boggling antiquity, a ridge-line in Stanly County—now a peninsula jutting

YADKIN-PEEDEE RIVER BASIN

GEORGE HUMPHRIES



Boone's Cave State Park

YADKIN RIVER BASIN **FACTS**

Atlantic drainage

Size of N.C. watershed: 7,213 square miles

Total streams and rivers: 5,991 miles

Major tributaries: Mitchell, Ararat, Uwharrie and Rocky rivers; Reddies, Dutchmans, Abbotts creeks

Municipalities: 81

Population: 1.2 million (1990)

Major land use: Forest

States flow through: Va., N.C., S.C.

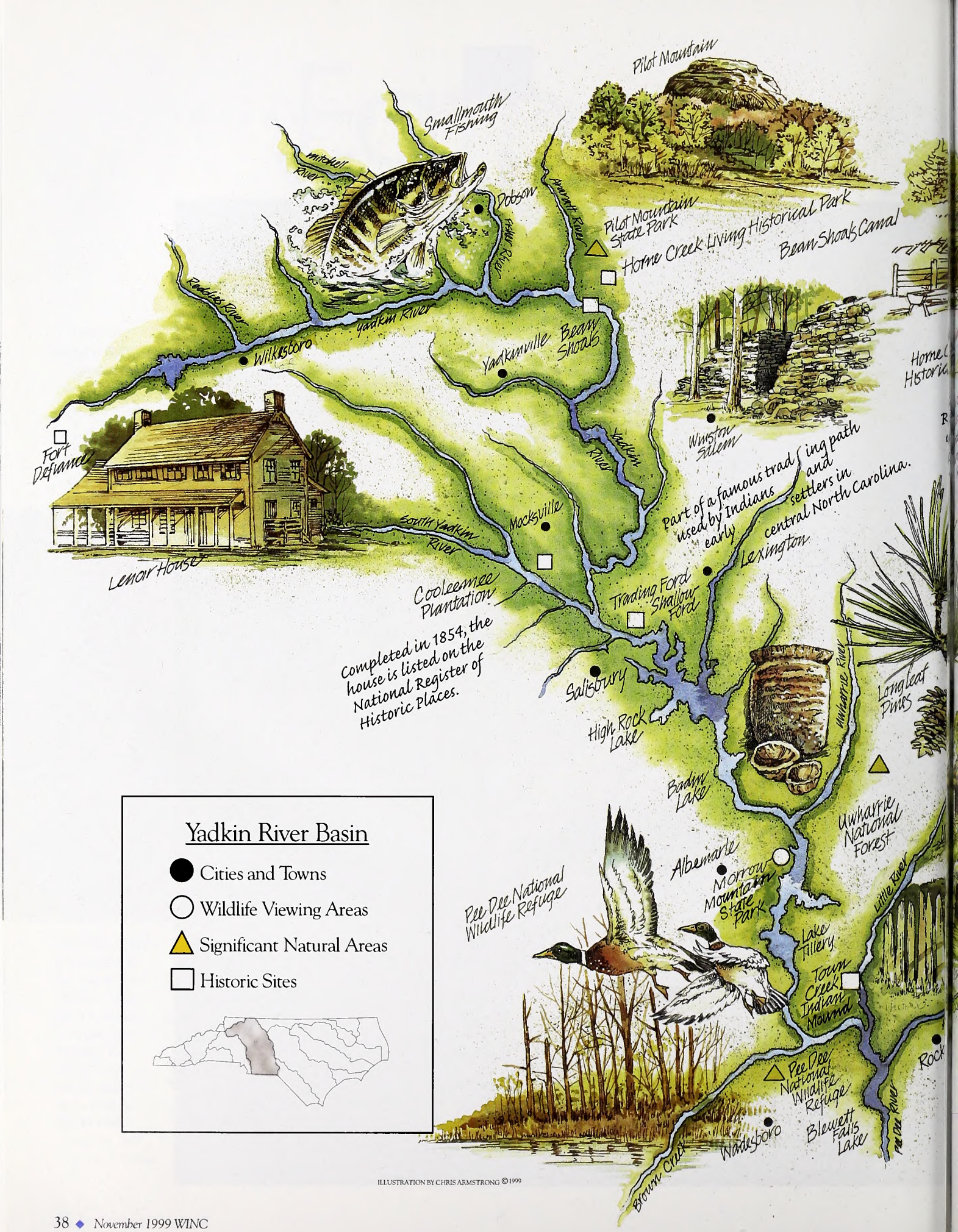


ILLUSTRATION BY CHRIS ARMSTRONG ©1999

center
to the study and
tion of North
olina's rural
heritage.

Town Creek Indian Mound

Creek

into Badin Lake—where paleo-Indians gathered for centuries to work stone into tools and weapons.

When the eminent archaeologist Joffre Lanning Coe discovered this knoll in the spring of 1937, he could only guess at its import to archaeology. Over the next six decades, more than 7 metric tons of cultural material would be recovered from the Hardaway Site, including more than 3,000 projectile points and 5,000 scrapers. Coupled with his 1948 discovery of the nearby Doerschuk Site, Coe would reconstruct the framework of human occupation in the Carolinas from about 12,000 years before present to circa 1700 A.D.

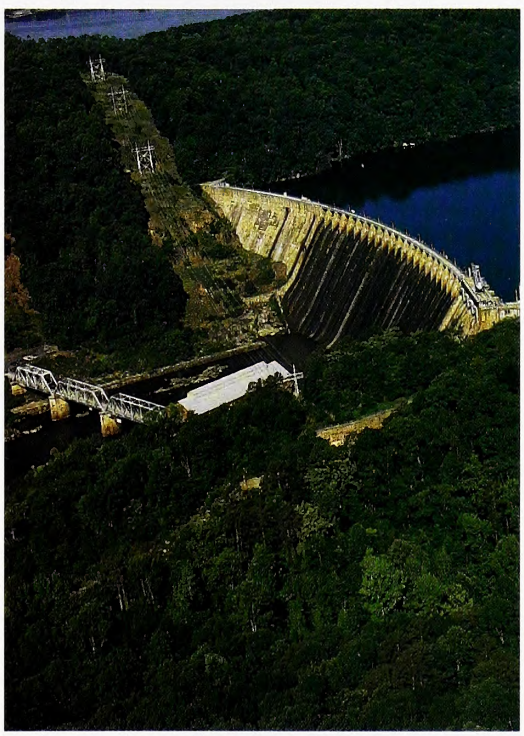
Why such a coalescence of human activity at this particular place? Had our ancient stoneknapper lifted his eyes from his work, he would have seen the answer: a river, flowing beneath this ridge through a 300-feet-deep notch in the Uwharrie Mountains. Paleo-Indians knew what modern man can now discern on a map: Water from four rivers and untold creeks and streams ultimately drain through the gorge—"like sand in an hourglass," as Coe wrote. For centuries this rugged gap called the Narrows funneled water, ancient peoples and emerging cultures. And as they came to the river to shape tools and weapons from stone, the river shaped them.

Whatever ancient words existed for that waterway have vanished, but today we know it as the Yadkin River—or more precisely, hydrologists will caution, the Yadkin-Pee Dee. From its headwaters near Blowing Rock, the Yadkin flows southwest across North Carolina's densely populated midsection. Interstate 77 soars over the river near Elkin. Interstate 40 crosses the Yadkin just west of Winston-Salem, near the 640 acres granted to Squire Boone in 1753, and owned later by his son, Daniel. Travel on Interstate 85, and you will cross it at Salisbury, site of the great Trading Ford, where John Lawson camped with Saponi Indians in the winter of 1700-1701. And travel south down Interstate 95 and you will cross the river 25 miles into South Carolina, after it has merged with the Uwharrie River in North Carolina's Montgomery County, where the married waters become known as the Pee Dee. Ultimately, the river pours into the Atlantic at Winyah Bay, south of Georgetown, S.C.

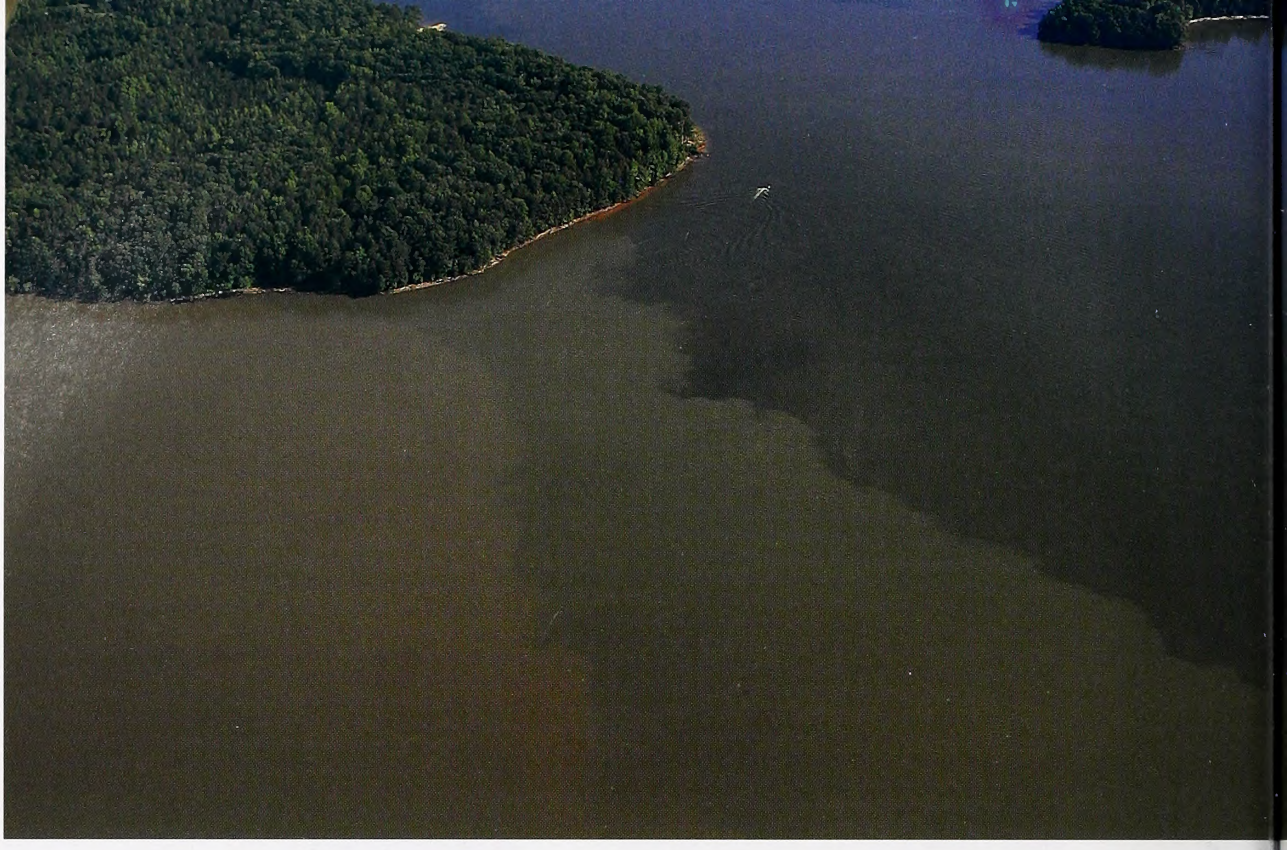
In the next few days I'll rely on bootsoles, canoe paddles and powerboats to explore this river and the influence of man on the stream, but for the moment I'm transfixed by the significance of the ground beneath my feet. Pottery shards are sown in the soil like seashells in dune sands: some impressed with corncobs and fish net, others scored with cord and various fabrics. There are stone drills, hammerstones, atlatl weights and hide scrapers. This knoll is like Tutankhamen's tomb to archaeologists of the American Southeast. In the same way, the Yadkin River is the Tigris and Euphrates of the Carolinas.

On this day, as on most, the Hardaway Site is a quiet stretch in the woods. The old excavations have been leveled out and sown in fescue, and the grass is waist high, a broad savanna hemmed in by forest. From a tulip poplar, a solitary vireo sings its throaty, three-syllable song.

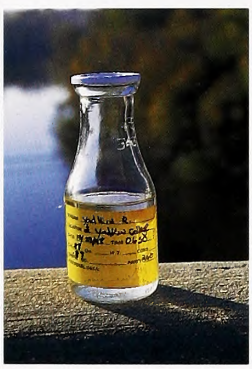
It is difficult to see today, but what is so archaeologically unique about the Hardaway Site, Oliver explains, is the deep stratification of artifacts. Most ridges erode and as they do, artifacts are swept downhill like seashells carried by ocean waves. What remains is a confusing context; hide scrapers 10,000 years old might be found next to hammerstones fashioned a mere 3,000 years ago.



The Narrows Dam *(left) was built in 1917 by Alcoa to generate hydroelectricity for an aluminum smelting facility. Much of the 5,350-acre reservoir created by the dam is surrounded by the Uwharrie National Forest, which contains a healthy bald eagle population.*



Water degradation *on the Yadkin River is caused mostly by sedimentation resulting from development. From the air, a sediment plume can be seen moving down river. Dan Richter, a professor at Duke University, takes a water sample near Yadkin College to measure suspended particles.*



Not so at Hardaway. In a ridgetop depression, Coe and other early archaeologists found stratigraphically intact deposits some 10,000 years old. Think of a layer cake, Oliver suggests; groups of ancient peoples gathered here with chunks of rhyolite quarried from the Yadkin gorge below. They camped for a period of time, leaving behind the industrial detritus that would be covered over with sediments washing off the surrounding rim of the ridgeline bowl. In time, other groups would appear and leave behind their own stone calling cards, which would again be covered with sediments. Time and time again. One 10-inch-thick layer of excavated Hardaway earth was comprised of nearly 70 percent artifacts and only 30 percent soil. "It was like digging through a place where somebody had dumped a gravel truck," Oliver explains.

With the materials gleaned from the Doerschuk Site downriver, archaeologists put together what they call a "continuous stratigraphic column" from the present back to about 7000 B.C. That's when a major occupation of the area began, characterized by paleo-Indians who chipped projectile points with concave bases (now called Hardaway points) about 10,000 years ago. Those points evolved over the centuries, from the Hardaway points to corner-notched projectiles of about 2,000 years later, to serrated blades made between 5000 B.C. and 6000 B.C. and so on. Before these discoveries, it was commonly assumed that Indian artifacts from the region were only 5,000 to 6,000 years old. The framework we now have for interpreting Southeastern artifacts "was born on the Yadkin-Pee Dee," Oliver explains.

But these days, a dense forest obscures any view of the river. For a better perspective, we drive down to the Narrows Dam, unlock a gate and walk

along the dam's narrow concrete spine. On one side, Badin Lake's impounded waters lie 15 feet below me. However, on the other side—four steps away—the world bottoms out. I teeter on the edge of a concrete cliff; watching swallows skitter through the air 50 feet below. It is an osprey-eye's perspective of what Oliver calls "the Grand Canyon of North Carolina."

From the top of the dam, I get a sense of the river's former spirit. Freed from the concrete barrier, the river flows unfettered for a few hundred yards, spilling eddies and froth behind boulders and along knuckle-like rock ledges. But it is a brief respite. As the Yadkin curls out of sight it pools, held in check by the impounded headwaters of Falls Lake, just downriver.

It is a brief but telling glimpse of a river that has given us the secret of ourselves. And I begin to wonder if we recognize the debt we owe to the Yadkin-Pee Dee.

A few days later I am far up the river, with a perspective—and canoe paddle—planted firmly in the present. With B.J. Cook, district conservationist for the Natural Resources Conservation Service, I'm paddling about six-and-a-half miles of the Yadkin, as the river turns south at Pilot Mountain. Cook outweighs me by 75 pounds, and even though my Lab, Emma, helps balance the load, the canoe is still in poor trim. Rock ledges force us to pick our way through S-shaped turns and riffles.

"Paddle on the right!" I call, just as a submerged boulder appears from behind Cook's straw cowboy hat. We drop over the ledge and bounce through riffles, shipping but a cup or two of water. Emma's ears are laid flat. I stow the paddle and marvel at the scene. River birches lean far across the stream, their curling bark reminding me of the old fuzz sticks I carved in Boy Scouts. A 50-foot rock bluff nods high overhead. After three hours of paddling, we have seen but two houses.

For most of its upstream miles, in fact, the Yadkin River flows through farmland. Its headwater tributaries—Stoney Fork, Reddies Creek, Roaring River, Mitchell River, Fisher River and Ararat River—spill from Blue Ridge woodlands, but for most of its flow the Yadkin courses through an agrarian landscape. In Cook's Yadkin County alone, there are 2,800 farms and 60,000 acres of farmland.

For many years, farmland was suspected to be the primary culprit for the Yadkin's most obvious, and serious, pollutant: sediment. Whether it washes off plowed farm fields or roars into rivers through feeder creeks overburdened with storm-water runoff, river sediment is a deadly pollutant. Silt smothers fish, frog and salamander eggs, and kills aquatic mussels and insect larvae. Sediment fills up water supply reservoirs. And turning muddy water into clear drinking water is expensive.

The "muddy Yadkin" has long flowed with the ocher stain of the Piedmont's clay-based soils. Heavy rains wash soil into the river at alarming rates. In the early 1980s in Yadkin County, Cook tells me, the average farm lost 62 tons of soil per acre per year. That's 2 million pounds of dirt for a meager 17-acre field.

***B.J. Cook,** a district conservationist with the Natural Resources Conservation Service, has been working with farmers in the Yadkin River valley to prevent soil loss. Through no-till farming and erosion-control measures, soil loss on some farms has been reduced 77 percent.*

Then came the farmbills of the late '80s and '90s. Talking about it, Cook turns into a kid describing the invention of the squirt gun. "That changed everything," he exults. Beginning in 1995, any farmer who applied for U.S. Department of Agriculture farm program benefits was required to install a farm-wide soil conservation plan. These plans are based largely on the benefits of no-till farming. Instead of plowing a deep furrow in the soil, no-till farming involves merely slicing a groove in the dirt and dropping in the seed. Because farmers no longer need to disk their fields between crops, vegetation remains in the fields year-round. Birds from quail to field-loving sparrows thrive. Rabbits find it easier to make a living. Farmers save money. And soil erosion rates plummet.

In fact, farmers in the Yadkin River valley have cut soil loss by a huge margin. On farms with conservation plans, the loss of soil per acre per year is down to eight tons, savings of a whopping 77 percent. By any measurement, that was a huge success and a testament to farmers' commitments to conservation.

While farmers and others were trying to reduce their impacts on the river, scientists were taking a hard look at Yadkin River water quality. Dan Richter, professor at Duke University's Nicholas School of the Environment, came across data from a U.S. Geological Survey water-quality monitoring station that had been in place for decades. He was stunned at the detail. "This was a world-class environmental record, just sitting there," he recalls. Every single day, from 1951 to 1995, and weekly since then, a water quality sample has been taken from the river at the U.S. 64 bridge at Yadkin College and analyzed for suspended sediments. Richter supervised graduate students who pored over the data to see how the river reacted to changing land use, soil conservation measures and a 1989 ban on phosphate detergents.

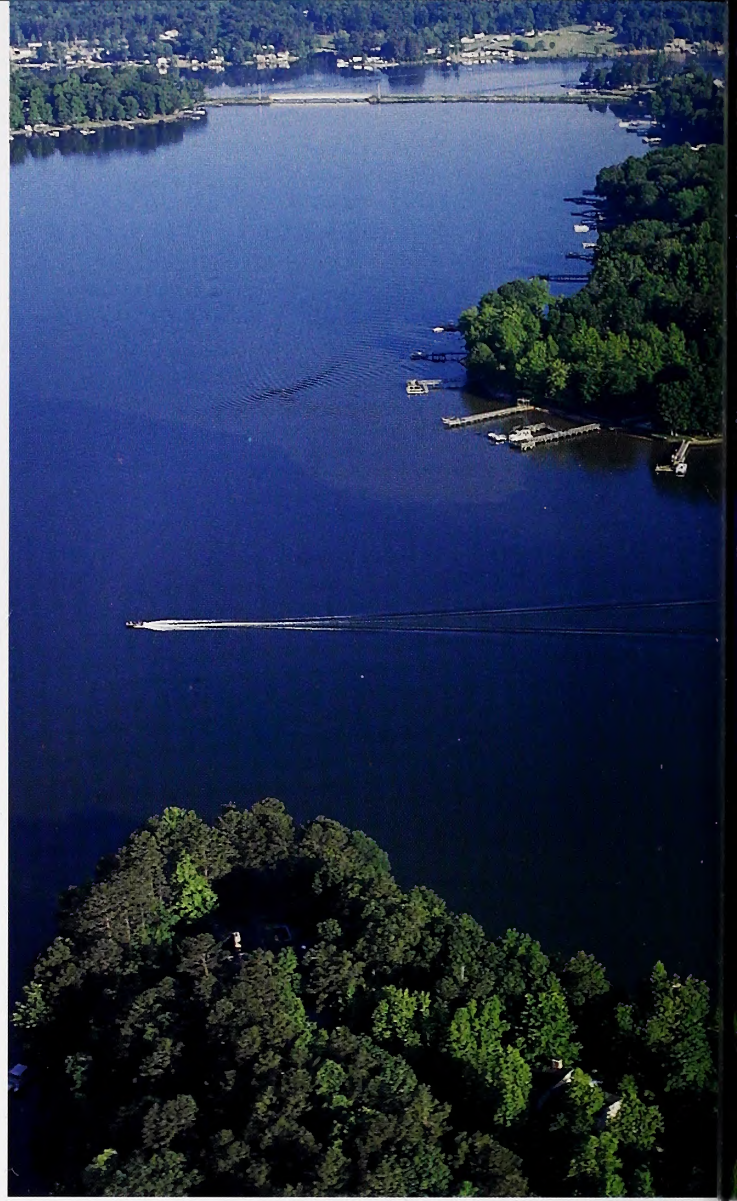
One of the first studies showed that phosphorus levels had dropped by 80 percent from the mid-1980s to 1994, thanks to the phosphate detergent

ban. "When I heard that," Cook recalls, "I was thinking these farmers would be up for the Nobel Peace Prize when the sediment levels were analyzed." But interestingly, Richter's students found that the huge decreases in agricultural runoff have not driven a correspondingly large drop in river sediment loads. "We think the river is transporting about 30 percent less sediment today than it was in the 1950s," Richter told me. That's great news, but it doesn't reflect the fact that farmers have cut sediment washing into the Yadkin by 108,000 pounds per year per acre in the last decade, alone.

So where's all that mud coming from? One potential answer lies in other statistics. From 1982 to 1992, the acreage of cultivated cropland in the region fell by 25 percent. But urban and developed acreage rose 38 percent, while population grew 25 percent.

Paddling downstream, Cook points out one result. "See that creek?" he says. It's a mere trickle of water, flowing through a chasm cut nearly 15 feet into the soil. "There's no reason little feeder creeks should cut out these canyons. But every time it rains an inch, 27,500 gallons of water fall on every single acre of land. Now, if that land is in grass and trees, the water walks off. But if it's around houses and roads and trailers and parking lots, then the water runs off, and it runs into those little streams. And they can't handle it. They're exploding, and the soil goes into the river."

He could be onto something. Streambank erosion is a hot topic in the Yadkin River watershed, largely due to the ground breaking—or ground-saving—work of Cook's Surry County counterpart, Dick Everhart (See "Friendly Persuasions," p. 114). "I think we now need to start up there, in those streams," Cook says. "If we don't fix the watershed from the top down, then what we do along the river won't matter much."



Near the canoe take-out on Old U.S. 421, Cook motions me to the right bank, and we tether the boat to a streamside shrub. Scaling the river bluff, we step through mature woods and into a sprawling agricultural complex. Emma streaks down the field, which abuts another field and another, for a mile, perhaps more, up and down the Yadkin floodplain.

"Look around," Cook invites. "You can see a microcosm of the issues facing the Yadkin." We're on the Mark Taylor farm, one of the region's most conservation-minded landowners. Thigh-high corn is growing up through a layer of wheat residue—the telltale signature of no-till farming. Checkerboard fields roll away in green corn and brown barley, framed with tree-lined hedges and intermittent streams. On distant slopes, cattle pastures wink from the forested hillsides.

But on the river bluff large new houses sprout like geometric blossoms. "You know," Cook says, "everybody likes to say that the problem is yours. But the quality of the river is really just an end result of everybody's actions."

For much of its run to the sea the Yadkin River is no river at all, but rather one of seven major reservoirs: Kerr Scott, High Rock, Tuckertown, Badin, Falls, Tillery and Blewett Falls. These last six form what is called the Yadkin Chain Lakes, built in the first half of the 20th century to power aluminum smelters and electric utilities. Spreading like a giant turkey print across southern Davidson and Rowan counties, High Rock Lake, dammed in 1927, is the first and the largest of the chain. And it is also the most threatened.

High Rock's 12,200 surface acres absorb more than a million tons of Yadkin sediment in an average year. That's good news for anyone downstream of the reservoir, but bad tidings for the lake's natural communities. Visibility in the lake is frequently less than a few inches and rarely over a foot-and-a-half. The lake's 4,000-square-mile watershed also poses huge challenges to water quality. The cities of Winston-Salem, High Point, Salisbury and Lexington are among the 195 permitted dischargers in the High Rock watershed, and high phosphorus levels have long plagued the lake. New regulations are directed towards lessening phosphorus discharges, and officially the lake is tagged as a "support-threatened" reservoir,

meaning the uses for which it exists are threatened by water-quality concerns.

Adding to the burden is a concern common anywhere natural beauty is found in the rapidly growing Piedmont region: development. High Rock is hot property. According to the *Salisbury Post*, 3,200 homes are found along the lake's shore, and 400 waterfront lots have been platted in the last 10 years alone. Already, state and federal authorities are concerned about the recreational carrying capacity of High Rock. And the people keep coming.

To see what's in store for the lake's wooded shores, Emma and I hop aboard a 17-foot runabout, manned—and dogged—by Lonnie Davis Jr. and his young retriever, Charlene. Few people know the High Rock country as well as Davis. Born here in 1938, Davis paddled a 16-foot Grumman canoe down the Yadkin as a 16-year-old, calling in newspaper accounts from North Wilkesboro to the coast. In 1946 Davis' father built the first cabin on High Rock, and Davis was practically reared at the lake. "I'd get out of junior high school," Davis recalls, "and hitchhike to the lake with a shotgun wrapped in newspaper. Duck hunt till dark. It was a real wilderness out there, virtually uninhabited."

And remained so, at least parts of the High Rock shore, for decades.

Davis cuts the outboard motor, and the dogs leap from the bow and bolt into the woods shrouding the surprising bulk of High Rock Mountain. Thirty-four years ago Davis and his son, Lee, were wandering through these woods when they happened upon a working moonshine still. Davis grins at the memory. "I hollered something like, 'Hit the dirt!'" he chuckles. "All I knew about bootlegging was what I'd seen on 'The Andy Griffith Show.' But I knew enough to

***Development** has exploded around High Rock Lake (above). To manage waterfront development, Yadkin Inc., an Alcoa subsidiary, created a Shoreline Management Plan, which limits the clearing of vegetation near the water. Long-time resident, Lonnie Davis (right), walks his dog, Charlene, along the lakefront.*

hope that no one would see us."

Today that tiny moonshiner's stream is nearly dried up in early summer heat, but we still pick our way along the fern-edged banks to a natural saddle anchored with a bathtub-sized pool, under a shagbark hickory. A rusty 55-gallon drum marks the spot. The day after discovering the still, Davis led state agents to this very place, where they destroyed a wooden box full of mash, bags of sugar, various drugs and planking.

This wild moonshiner's mountain, on the west shore of the lake above High Rock Dam, was long considered a natural jewel of the Yadkin-Pee Dee basin. In the early 1990s the state mulled over purchasing 2,000 acres of its gorgeous hardwoods, but passed. Where the state lacked cash, however, speculators stepped up to the plate.

Advertisements for "The Springs" community are now splashed across the state. Three miles of shore are slated for development. Lots start at $49,880. There will be a gated security entrance, a waterfront clubhouse, boat storage—the works. When completely developed, there will even be a 50-acre "wildlife park."

Already the changes are obvious and insidious. The cobbled streambed now sports red mud 6 inches deep, sludge washed down from construction gashing through the woods. A 4-mile road has been carved through the trees, and the first clearings blink through the forest canopy. "They'll build a hundred mansions up here," figures Davis. "Come back in five years and it'll make you cry."

N.C. ARCHIVES AND HISTORY

Motorists use the *Blewett Falls Ferry (above) to cross the Pee Dee River during the 1920s. Groups of concerned citizens have formed to protect the Yadkin River from environmental harm. Representatives from left are: Kevin Nunnery, project manager for the Triangle Group; Jeff Michael, executive director with the Land Trust for Central North Carolina; Dr. Doug Frederick, vice president of the Triangle Group; Gene Fox, an intern involved in an environmental science program at Catawba College; Beth Bohling, director of development for the Land Trust for Central North Carolina; Barrett Lasater, chairman of the Yadkin-Pee Dee River Basin Association; Laura M. Fogo, a biologist working at the Pee Dee National Wildlife Refuge; Dr. John Wear Jr., president of the North Carolina Watershed Coalition; and Greg Greene, with the Yadkin-Pee Dee River Basin Association.*

Davis knows that his lamentations might sound like a man soured that his corner of paradise has been discovered. But the new wave of High Rock development is a far cry from small summer cabins tucked into shoreline woods. Four-thousand-square-foot homes are common, and in many places, landowners have shaved the shoreline nearly bare for a precious water view. Runoff from new construction and impervious roofs and driveways has nowhere to go but into the lake. The rate of development has soared, and with it, the impacts on the waters and woods and the creatures that live there.

Yadkin Inc., the Alcoa subsidiary that controls land use around the reservoirs, has struggled mightily with the issue of appropriate shoreline development. In late 1997 the company announced its draft version of a new shoreline management plan, and local developers, the real estate community and county commissioners led a hue and cry against development restrictions. Taking those comments into consideration, Yadkin Inc. went back to the drawing board, and announced a final plan in June 1999. The document has received high marks from water-quality advocates. "It's a tremendous effort on Yadkin Inc.'s part to get water-protection strategies incorporated into shoreline management," says Darlene Kucken of the state Division of Water Quality. "Yadkin really took some hard knocks in the early going. They're to be commended for this effort."

In particular, Yadkin held the line on a new focus to bolster forested buffers around the lake. Hamstrung by the fact that most High Rock landowners own lots that extend to the lake's full-pool contour, Yadkin proposed what Gene Ellis, of Yadkin Inc., calls "a fair and equitable exchange."

In exchange for permission to build a pier into the lake, property owners must agree to a 100-foot building setback and constraints on vegetation pruning. "We want to be good neighbors," Ellis told me, "but at the same time, we're raising our standards as environmental stewards." The forested buffers will protect water quality, aesthetic values and wildlife habitat.

But the burden isn't Yadkin Inc.'s alone. Thousands of acres of undeveloped land lie in sight of the High Rock shoreline, most of it out of the company's purview. It will take commitment from local governments and individual landowners to ensure that portions of High Rock resemble the unspoiled woodlands of the past.

For his part, Davis is making sure that his little cove will be a well-wooded respite. Just a few days before my visit, the Davis family and the heirs of Casper Timberlake donated 16 High Rock acres to the Land Trust for Central North Carolina.

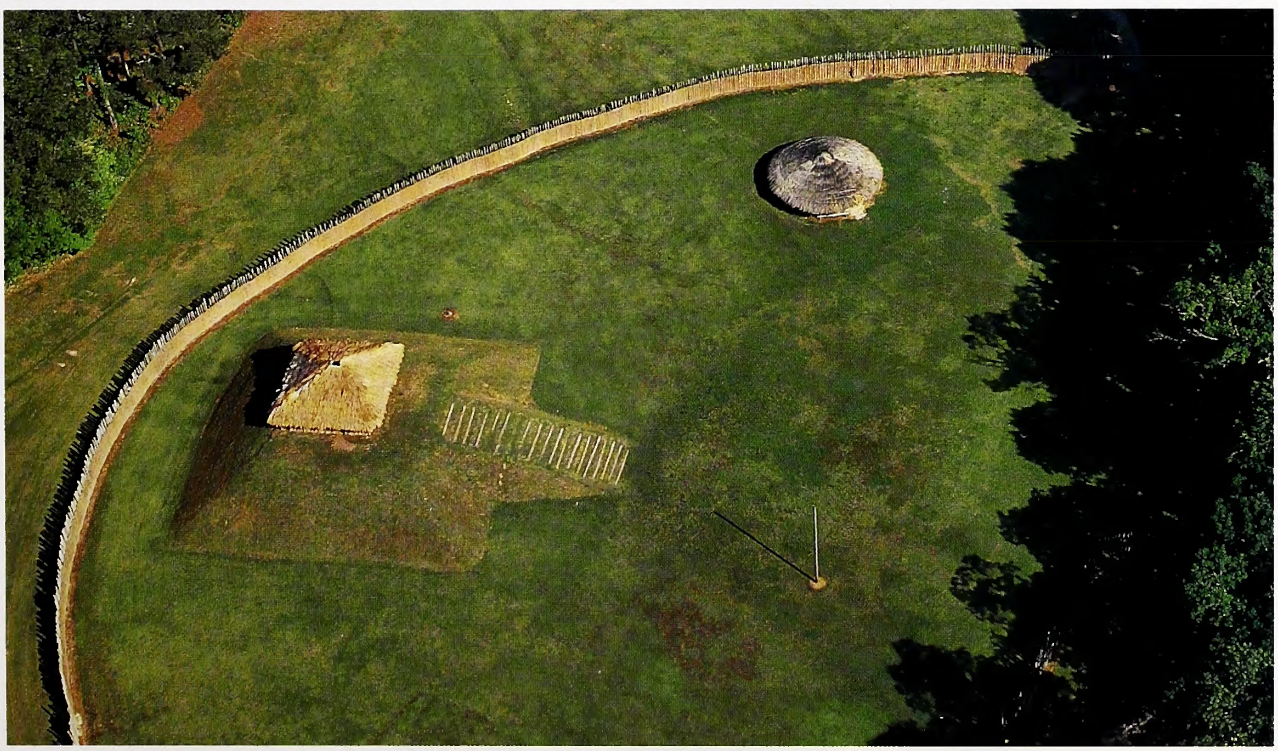
The Yadkin's earliest human inhabitants would have found a conservation easement a curious thing. I can't help thinking of this as I pull away from High Rock Lake, and the thought brings to mind an insight I'd had just a few days before.

Billy Oliver was leading me to the Doerschuk Site, two miles upstream of the confluence of the Yadkin and the Uwharrie rivers. We crossed Falls Dam, from which we gained an astounding river view. To the south the mountainous land flattened, rolling towards South Carolina in diminished swells like a calming sea. Somewhere beyond, two dams remained to check the river's flow, but the view from the highlands around Doerschuk was of a brimming river, boisterous with the spirit of moving water.

Though despoiled by ATV trails and heavily looted, Doerschuk still boasts shoals of stone flakes lining the riverbank, in sediments as old as 8,000 years. Amidst river cane and greenbrier, Oliver picked out hammerstones and flakes from sandy soil skimmed with water oak leaves, and showed me an oval stone the size of an eggplant, and the color of a wood thrush. Indentations pocked two sides—the rock was a rudimentary anvil. I couldn't help but be carried away by the aura of a place where the script of ancient man was written in the ground beneath my feet.

For 12,000 years, man has lived and worked by this river. Yet the remains of most of that occupation are so minimal that we must dig and sift the dirt to content ourselves with chips of stone. Not so the evidence of the current century. Our modern occupation of the Yadkin River region has left behind massive concrete dams, wastewater from 83 municipalities and runoff from sprawling development and vast agricultural fields. New concerns are emerging, from a growing swine industry in the Yadkin-Pee Dee basin to the incessant drumbeat of growth that is the Piedmont's mantra.

Through it all, this river has flowed, its gift a vision of time past and to come. I was beginning to understand two things about the Yadkin-Pee Dee. What we know of our most ancient history we know largely from the woodlands and waters of this river. What we make of our future is likely to be found there, as well. ⊠

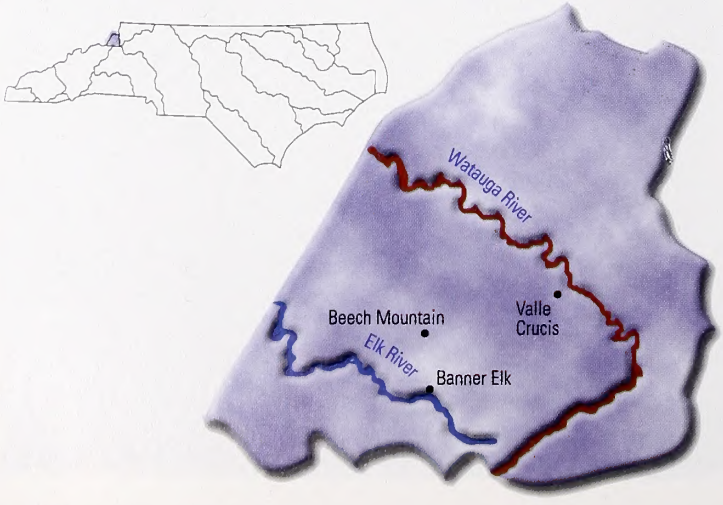


The Town Creek *Indian Mound site was used by the Muskhogean-speaking Indians of the Pee Dee area about 300 years ago. The tribal ceremonial center is located on a bluff overlooking the Little River.*

BLUE RIDGE Jewel

You hear it as you descend the Shanty Springs Trail from the heights of Grandfather Mountain—a hissing in the forest that rises and falls as you follow the contours of the land. Instinct draws you to it, as it must have drawn man from time immemorial. For water means relief from thirst, relief from hunger and something less tangible but equally compelling—simple beauty. A footbridge appears at the base of the mountain, and finally you see it. Boulder-strewn, gin clear and full of fishy-looking pools, the Watauga is as pretty a river as you will find in the Blue Ridge. The trouble is, everyone wants a piece of it, and piece by piece, it could disappear.

The Watauga River is the crown jewel of the Watauga River Basin, most of which lies in the county of the same name. Encompassing only 184 square miles, the basin is the second smallest in the state. Yet it figures highly in the hearts and minds of local residents, as well as the thousands of vacationers who visit the region each year to hike, fish, golf and ski. The streams in the Watauga Basin generally have excellent water quality, with more than 15 percent classified as Outstanding Resource Waters or High Quality Waters. Some sections support populations of native brook trout, and many more are stocked with hatchery-raised rainbow, brown and brook trout. The Watauga, in particular, is a magnet for anglers. On a single Saturday in 1998, N.C. Wildlife Resources Commission enforcement officers counted more than 100 anglers on a 3-mile stretch of the river.



The main stem of the Watauga River rises on the north side of Grandfather Mountain on land protected by The Nature Conservancy. At the base of the mountain, it leaves that sanctuary and enters a valley that serves as one of the area's principal transportation corridors, residential areas, commercial districts and recreational centers. The mountainous terrain focuses building activity in the floodplain, yet every new construction project brings the threat of increased sedimentation. Stream temperatures rise as the tree canopy is removed. And "No Trespassing" signs appear where none were before. Between 1980-1996, Watauga County's population grew by more than 26 percent, and that growth rate is expected to continue for the foreseeable future. Many wonder how this growth can be accommodated without compromising the water quality of the Watauga, not to mention the fishing experience.

"The biggest threat to the river is new development," says Ollie Smith, co-owner of Foscoe Fishing Co. and Outfitters, a local tackle shop and guide service. "We've got one development going in that will put 50 homes along the river, and a second one—a private fishing club—that will close off a large stretch of Delayed Harvest trout water to the public. It seems we are being pushed onto smaller and smaller sections of river. I don't know where it's going to end."

There is little the state can do to add to the miles of fishable water on the Watauga, but there is action underway to try to preserve water quality and repair damaged streambanks. Nonpoint source pollution, primarily from development but also from agriculture and forestry, poses the main threat to water quality in the Watauga basin. A Watauga River Basin Nonpoint Source Team, composed of representatives from local, state and federal governments, has developed a multi-faceted plan for improving water quality in the basin. Its action arm, the Watauga River Basin Steering Committee, has completed stream restoration projects on several tracts of land. The committee has also trained a network of volunteer "Stream

WATAUGA RIVER BASIN FACTS

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Mississippi drainage

~

Size of N.C. watershed: 184 square miles

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Total streams and rivers: 283 miles

~

Major tributaries: Elk and Watauga rivers

~

Municipalities: 6

~

Population: 16,083 (1990)

~

Major land use: Forest

~

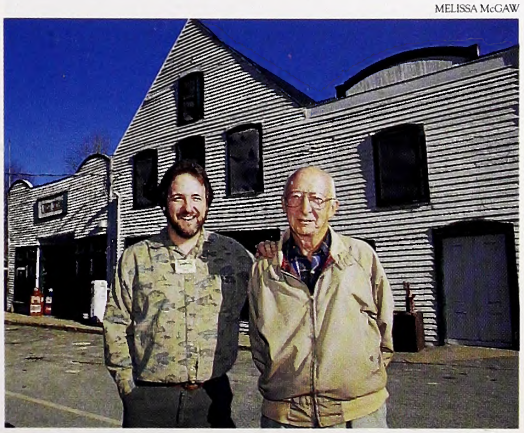
States flow through: N.C., Tenn.

MELISSA McGAW

Anglers revere *the Watauga River for its trout. This fisherman is trying his luck on Boone's Fork Creek, a tributary of the Watauga. At the Mast General Store (below) in Valle Crucis, H. Mast (at left) and Allen Mast stand behind the saying, "If you can't buy it here, you don't need it." The store has been in operation since 1883.*

Doctors" who monitor the Watauga for temperature, pH and dissolved oxygen, as well as numbers of macroinvertebrates. This data provides a clear picture of the condition of the Watauga, which remains good, and gives the committee a base-

MELISSA McGAW



line to compare for the future.

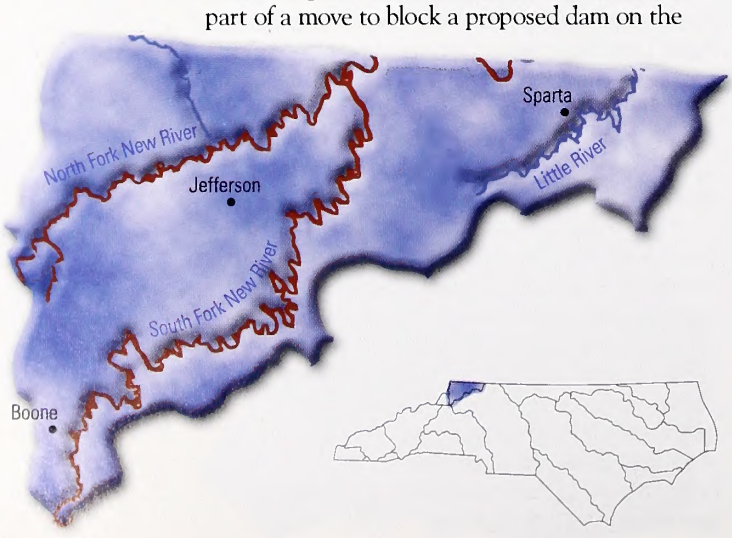
Other groups are pitching in to maintain the scenic character of the river. The Blue Ridge Rural Land Trust has received funding to conduct a riparian corridor assessment of the Watauga, identifying problem areas along the river and land preservation requirements. The trust is encouraging landowners to donate scenic easements along the river as well as outright gifts of land.

All of this activity is leading locals to be cautiously optimistic about the future. "We are in the enviable position of seeking to maintain streams with excellent water quality, rather than trying to bring degraded streams back to life," says Mike Pittman, director of the Watauga County Agricultural Extension Service. "There is more public awareness of the need to preserve water quality than I have ever seen before, and that gives me hope that we can save our streams despite the inevitable population growth."—*John Manuel*

NEW RIVER Rhythm

Brian and I eddy out below the rapid and wait for the rest of the canoeists to come through. It's not a difficult rapid—two small ledges with a rock at the bottom that can easily be avoided with a draw to either side. The first couple navigates the run without trouble. The second couple—a mother and daughter—line their canoe up and slide over the top ledge. As they cross the second ledge, they freeze in mid-stroke. The canoe rushes forward, bangs against the rock and tips dangerously to one side. For a moment, it looks as if the boat will roll over, but it swings sideways and rocks back to level. The girl in the bow shrieks with laughter. The woman in the stern does the same. There's no need to worry, no need to hurry. It's a sunny afternoon and we're on the New River.

Born in the Blue Ridge Mountains of northwestern North Carolina, the New travels as two separate streams—the North and South Fork—for 43 and 72 miles respectively before converging near the Virginia line. Both forks are gems—clear and clean, and loaded with aquatic grasses, macroinvertebrates and game fish. But it is the South Fork that garners the most attention. In 1976, as part of a move to block a proposed dam on the river, the federal government declared 26 miles of the South Fork a National Scenic River. The state followed suit by establishing the New River State Park and setting up canoe access and camping spots along the river. Those facilities, combined with the easy (Class I-II) rapids and gorgeous scenery, make the New River ideal for recreational canoeing.

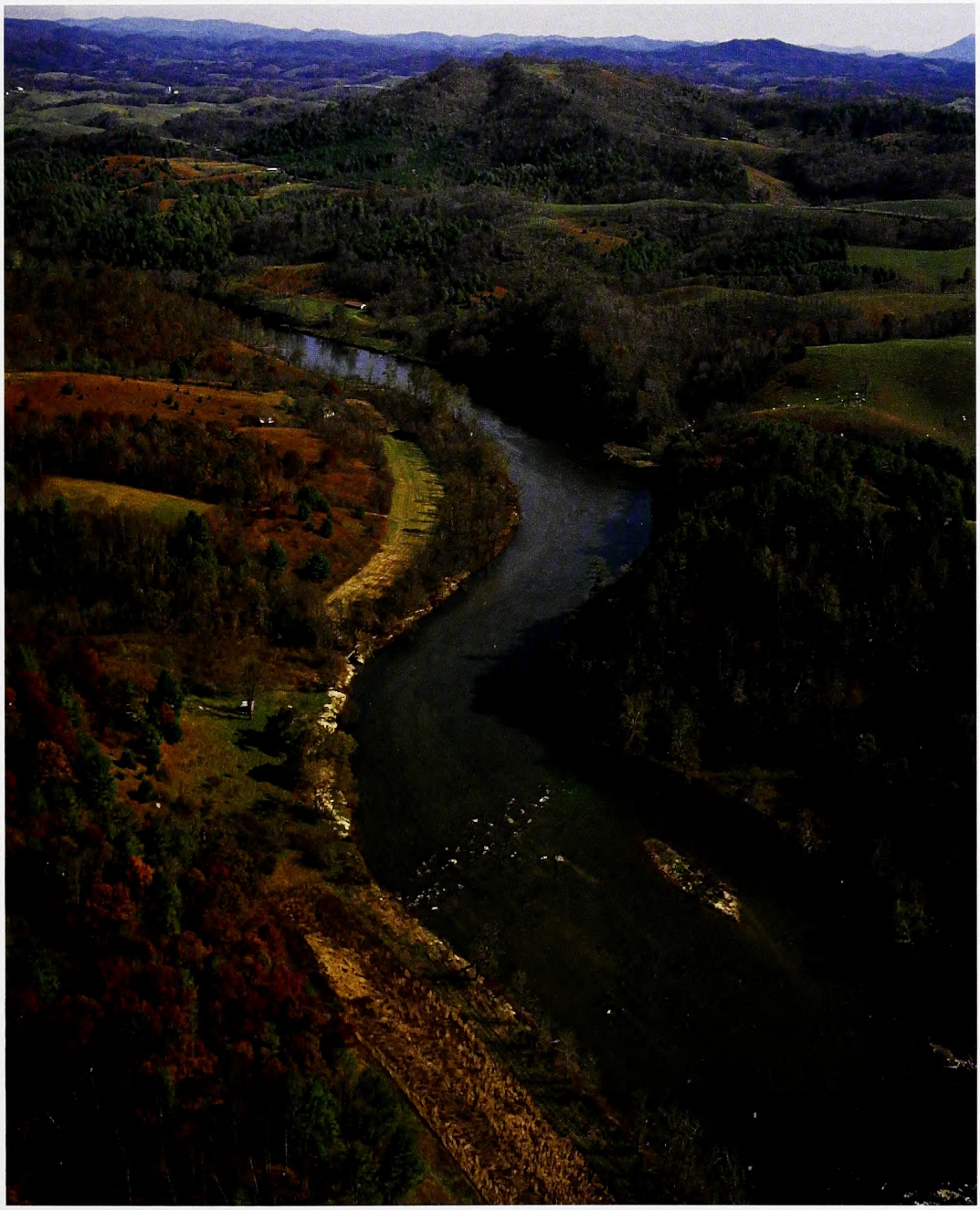


In 1998, the New was honored again by being named an American Heritage River. As our group paddles downstream, the river bends to the north, revealing the massive hulk of Mount Jefferson. Brian points out the swath of yellow and orange near the top where the maples and poplars have started turning. Soon, the whole mountain will be ablaze with color. We swing back to the south, and a meadow unfolds before us, hayrolls spread across the slope in a landscape artist's dream. Geologists tell us that the meandering path of the New in the midst of this mountainous topography is evidence that this river is very old, predating the rise of the Appalachian Mountains. Some claim that the New is the oldest or one of the oldest rivers in North America, dating back hundreds of millions of years. Others say it is impossible to date rivers that far back in time because the landscape has changed so much. What matters most is not the age of the river, but whether we can preserve it in the near-pristine state in which it has survived. That remains in doubt.

Tucked away in the remote hills of Ashe and Alleghany counties, the New has been spared the development and pollution that has marred many other mountain rivers. Most of the land in the 765 square-mile watershed has remained in forest cover or pasture, with some row crops here and there. But small-scale farming is no longer profitable, and many landowners are being forced to consider other options to pay their bills. Real estate developers are knocking at the door, eager to subdivide the land for vacation homes. In fact, hundreds of new homes have been built along the New in the past two decades, and people are quickly waking up to the fact that the bucolic nature of this watershed cannot be taken for granted. Groups such as the National Committee for the New River are hard at work trying to secure conservation easements along the river, as well as promoting activities such as sustainable agriculture and low-impact development that might generate some income for landowners without compromising the ecology and

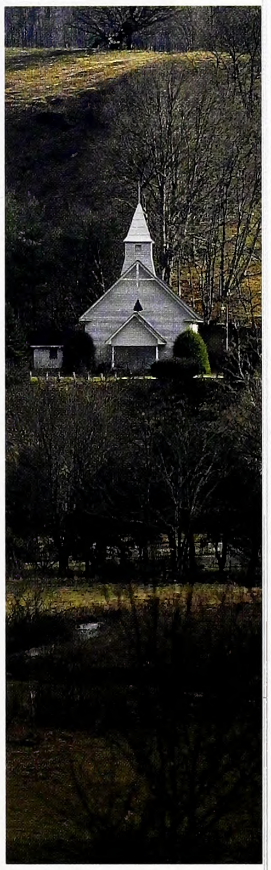
NEW RIVER BASIN FACTS

- Mississippi drainage
- Size of N.C. watershed: 765 square miles
- Total streams and rivers: 825 miles
- Major tributaries: South Fork New, North Fork New and Little rivers
- Municipalities: 6
- Population: 53,662 (1990)
- Major land use: Forest
- States flow through: N.C., Va., W. Va.



KEN TAYLOR

MELISSA McGAW



Meandering *through the lovely Ashe County landscape, the South Fork New River shows why it has been named a National Scenic River. The Sutherland Methodist Church (above) sits above the river in Ashe County.*

the scenery. It will take money, persistence and much goodwill for these efforts to succeed, and not every piece of riverside land will be preserved. But for now, there is still much to be enjoyed.

Brian and I eddy out below a ledge and face upstream. There's a nice looking hole to the right where the current runs beside a meadow. I break out my fly rod and tie on a fluorescent popping bug. A couple of false casts and away she goes. The popper lands just beneath the ledge, and before I can relax my arms, a smallmouth bass streaks forward and nails it. The fight of these New River bronzebacks always surprises me, and when it finally comes to rest in my hand, I can't believe the fish is only 10-inches long. I release the fish into the stream where it darts to the safety of the olive-green waters. With luck, it will be here many years from now, along with the meadow that sweeps back to the white, clapboard farmhouse nestled in the lap of the dark mountain.—*John Manuel*

ROANOKE'S dazzling diversity

written by Garnet Bass ©1999

photographed by Melissa McGaw

It was the "River of Death" to the Indians and early settlers, and its spring torrents claimed many lives. But in exchange, the Roanoke River deposited layers of rich sediments onto a bountiful floodplain. Perhaps that's the secret behind this wonderland of life, where sporting legends are as thick as swampland cypress trees, and where biological and botanical marvels are daily discovered.

One by one, they found the updraft. First, a lone juvenile with wings spread wide made lazy, looping circles high above the riverbank. Then came another juvenile, followed by an adult, then another adult. Four bald eagles, perhaps this year's fledglings and their parents, shared an instinctive quest—to catch the thermal. Higher and higher they soared, seemingly oblivious to everything but the pleasure of the ride. If they bothered to look, they saw below a sight as magnificent as they: the lower Roanoke River floodplain.

For thousands of years, the Roanoke River has worked magic across the Coastal Plain, carving and rebuilding the landscape and blessing it with fertility. From Roanoke Rapids to the Albemarle Sound, it has created hillsides filled with delicate cool-climate flowers, prolific hardwood bottomlands, canebrake terraces that harbor the rare Swainson's warbler, mythical swamps where knobby knees anchor the roots of towering bald cypress trees, pocosins deep in peat, and soggy, marsh grass terraces.

Man, beast and bird have benefited. The Roanoke is legendary among hunters and fishermen. Some of the state's highest populations of white-tailed deer, wild turkey and black bear find sustenance and protection in the unbroken woodlands. Its waters bubble and thrash with fish that have built industries and reputations. Raptors, waterfowl and songbirds abound. So, too, do the lesser creatures. Bats, crayfish, fairy shrimp, leopard frogs, cottonmouths and moths help weave this rich and complex web of life.

"The Roanoke has vast biological resources, in part because it's so large," says Merrill Lynch, assistant director for protection with The Nature Conservancy's North Carolina chapter. "Of all the rivers in North Carolina, it has the widest floodplain."

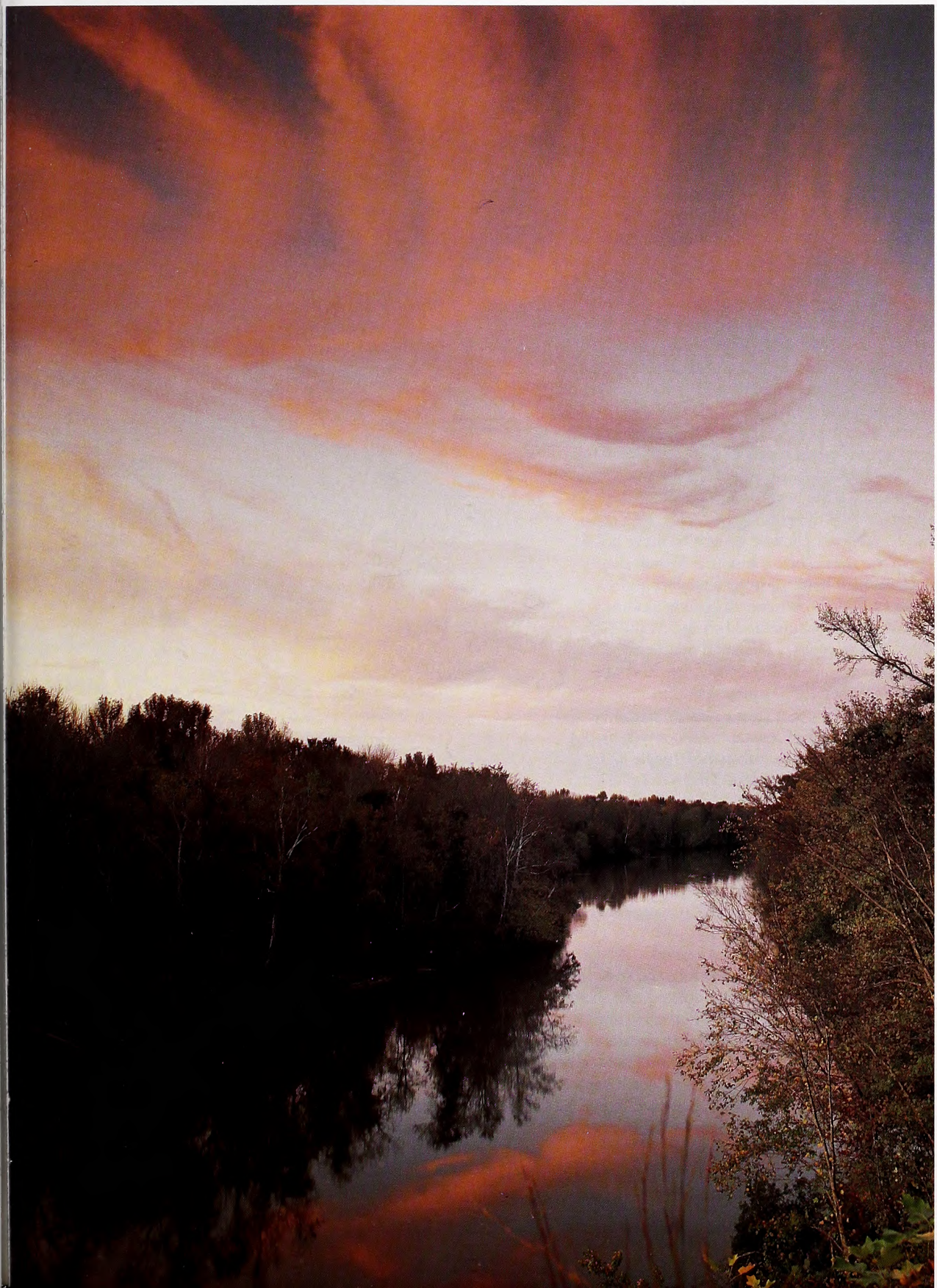
It was Lynch who first detailed the Roanoke's great diversity.

Working in 1981 for the state's Natural Heritage Program, he identified 15 distinct plant communities within the floodplain and five more on the adjoining ridges. Lynch called it the "largest intact and least disturbed bottomland forest ecosystem remaining in the mid-Atlantic states."

Conservation agencies took the cue. Through the collected efforts of The Nature Conservancy, the U.S. Fish and Wildlife Service, and the N.C. Wildlife Resources Commission, more than 34,000 acres of the Roanoke floodplain have been brought into conservation ownership. With an additional 21,000 acres of Georgia-Pacific timberland under conservation management, these agencies have preserved an almost continuous forested corridor stretching from Hamilton to the sound.

***Sunset paints** the brooding waters of the Roanoke River near Fort Branch (right). Near Weldon, unusual topography and soil result in spectacular displays of the rare wild hyacinth, Camassia scilloides, (top left) that bloom on the floodplain slopes.*

ROANOKE RIVER BASIN



CARL V. GALIE JR.

ROANOKE RIVER BASIN **FACTS**

Atlantic drainage

Size of N.C. watershed: 3,600 square miles

Total streams and rivers: 2,400 miles

Major tributaries: Dan, Mayo and Cashie rivers; Conoho, Country Line and Smith creeks

Municipalities: 37

Population: about 263,661 (1990)

Major land use: Forest

States flow through: Va., N.C.

Little wonder that as the bald eagle recovered from near extinction, it found its way back to the banks of the Roanoke. For years, only a single pair nested at the mouth of the river northeast of Plymouth. Now Jerry Holloman, manager of the Roanoke River National Wildlife Refuge, spots as many as a dozen eagles while making the run from Weldon to Hamilton. But four at once, on a single thermal? On this day, Holloman and I are glad to have each other as witnesses.

Northernmost of the great brownwater, or alluvial, rivers of the Southeast, the Roanoke begins as a trickle in the Blue Ridge Mountains northwest of Roanoke, Va., and courses southeast for 400 miles before emptying into Albemarle Sound at Bachelor's Bay. By the time it reaches the fall line near Roanoke Rapids, it has already drained nearly 8,000 square miles.

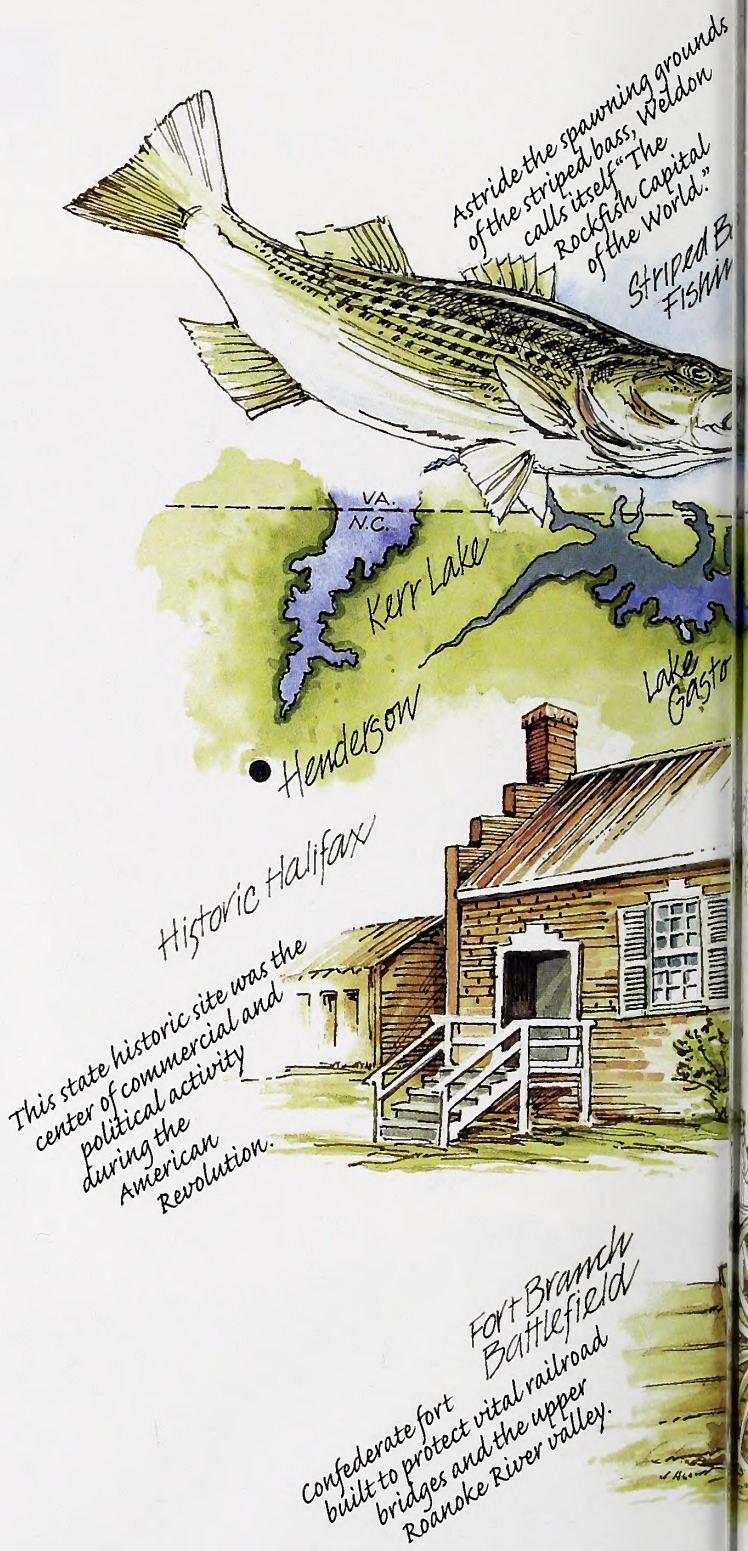
At the fall line, the river crashes onto the Coastal Plain in a plunging, swirling series of rock-strewn rapids. Whitewater canoeists like this stretch best when the water is low enough to turn one 5-foot drop, nicknamed the Rooster's Tail, into a Class 4 rapid. The river was gentler on the day a couple of self-proclaimed river rats guided me down, but to the novice approaching the last and greatest of the rapids, it sounded like Niagara Falls dead ahead.

As we came out of the rapids and headed the canoes toward the Weldon boat ramp, Chris Wicker pointed to a notch in the riverbank that once marked the beginning of the Roanoke Canal. In the early 19th century, the rapids had played havoc with people who sought to move goods along the river. Their solution: a 10-mile detour with earthen banks, a stone aqueduct and a series of locks. Today this national historic landmark is a walking trail frequented by joggers, the high school cross-country team and nature lovers.

From the rapids to the coast, the Roanoke drains another 2,000 square miles, carrying more water than any other river in North Carolina. The route through the Coastal Plain is anything but straight: 70 miles as a task-minded eagle flies, 137 miles as the river meanders. The river carved the floodplain up to 5 miles wide through cycles of rising and falling sea level and ancient monsoonal rains. The formation of the Outer Banks and Albemarle Sound slowed its flow and steadied its course. In the last 200 years, the Roanoke has made only one notable course change. In 1940, it abandoned an old meander and cut a straighter path near Hamilton. An oxbow lake remained behind.

Just downstream from Weldon, the river left behind something else. Steep, isolated hills shelter a collection of plants you won't find again until you reach Ohio, reminders of an age when glaciers cooled the continent. The Nature Conservancy now owns two such tracts, Camassia Slopes in Northampton County and Larkspur Ridge in Halifax County.

The timing was perfect when Jeff Horton, coordinator of The Nature Conservancy's Roanoke River Project, guided me over a couple of hills and around a bend in early May. Underneath a hickory oak canopy, Camassia Slopes was covered in the flowers that gave them their name. Pale blue blooms, each with six delicate petals and six yellow stamen, dotted the foot-tall spikes of *Camassia scilloides*. Deep blue larkspur (*Delphinium tricorne*) and pink-striped spring-beauty (*Claytonia caroliniana*) competed for attention as exotic honeybees and their small native cousins darted among the flowers. Overhead, buckeye (*Aesculus octandra*) added a splash of yellow, and pawpaw (*Asimina triloba*), a little burgundy. At the top of the hill, hun-



dreds of mayapples (*Podophyllum peltatum*) flowered beneath umbrella-like leaves. Turtles would have a feast come summer. In the meantime, other creatures dodged our steps—a fat orange velvet ant and a tiny pine tree frog, its green skin iridescent in a shaft of light. Overhead, an Acadian flycatcher's sharp *pit-see* split the air.

On the floodplain floor below us, the sediment measures 20 feet deep. Radiocarbon-dating indicates that this soil washed down from the Piedmont about 200 years ago as settlers cleared the

In Northhampton County, centuries of seasonal flooding have dumped deep deposits of sediment along the small guts or streams that connect to the river. The fertile soil supports a lush plant life, one reason for the abundant wildlife populations along the Roanoke.

land on a massive scale. When the river hit the Coastal Plain at the rapids and lost its power, the soil settled out over the floodplain for many miles downstream. The river now drops its load a hundred miles upstream, courtesy of a series of dams. When it continues its journey unimpeded toward the sound, it picks its once-deserted sediment back up again only to redeposit it farther downstream.

Wild turkeys haven't learned to flee from the sound of a motorboat. They ignore the intrusion and continue to forage along the riverbanks, occasionally making a low flight across the river. Up on a ridge near Weldon, Bill Johnson keeps a close watch for them. A retired forester, he manages his own wildlife sanctuary on 350 acres he owns and rents. He has been honored for his conservation efforts by the National Wild Turkey Federation, and he's the only person I've ever met who wears turkey droppings pinned to his hat.

"I've been hunting and fishing up and down this river since I could remember, and I'm still hunting and fishing," he says. "I've flipped a boat over once or twice, too." He has seen plenty of changes come to the river, good and bad, but one thing has been constant. "Wild turkeys been here longer than anywhere else," he says.

It's true. When overhunting eliminated wild turkeys from most of the state, they managed to hold on in the remote, productive reaches of the Roanoke River wetlands. Eventually, they became part of the stock for a statewide restoration program that has placed turkeys in 99 of the state's 100 counties.

"The floodplain along the Roanoke River has some of the best quality habitat anywhere in the state," said Mike Seamster, wild turkey project leader for the N.C. Wildlife Resources Commission. In a good year, you may find 15 to 25 turkeys per square mile. But the population varies with the river. Prolonged spring and summer flooding often decimates nesting and foraging habitat for turkeys, causing wide fluctuations in population and abnormal age clusters. "Whole age classes are basically missing," Seamster said. "This is far from ideal trying to manage the population for sustainability. No one knows what will happen over time." I would hear this again and again.

Once the river ran wild and free. Most summers, it would dry to little more than a trickle, but in winter and spring, rain would send it surging over its banks in torrents.

The floods made the land fertile. " It's not sandy Coastal Plain soil," says Alex McLennon, who raises 1,000 acres of cotton near Scotland Neck. "It's heavy clay loam that stays wetter and cools off slower, like Piedmont soil."

That didn't keep McLennon's ancestors or their neighbors from trying to hold back the floodwaters. Remnants of slave-built earthen levees, once 12 feet high and 40 feet across at the base, can be found along 70 miles of the river. The levees seldom held their ground against the mighty Roanoke.

In August 1940, there came a flood that would change the Roanoke for all time. Ten to 15 inches of rain fell in two days. The river rose fast and high. Thousands of people were evacuated, their homes

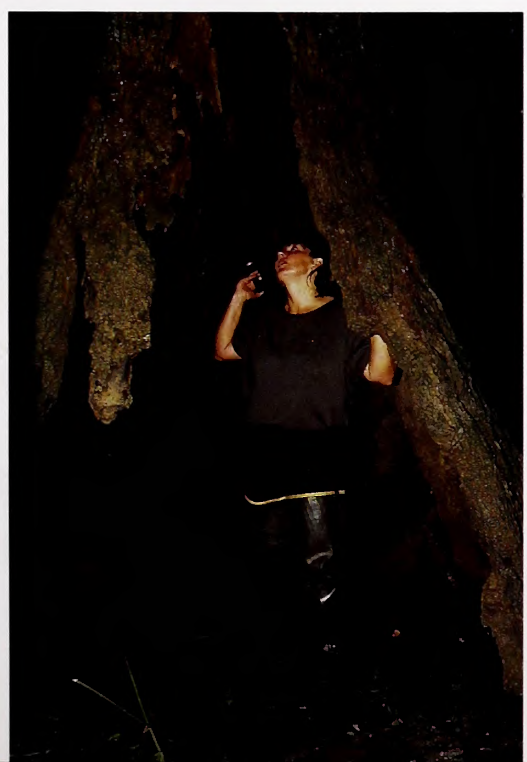
and businesses inundated. A Coast Guard cutter patrolled the sea where U.S. 258 had been. Roads and crops were destroyed all the way to the coast.

Enough, the people said, and called on Congress for help. In 1953, at a place called Buggs Island, the U.S. Army Corps of Engineers closed the final gates of the John H. Kerr Dam. Virginia Power and Light Co. followed quickly behind, creating dams and two reservoirs—Gaston Lake and Roanoke Rapids Lake—just downstream. These three lakes now drown 82 miles of the Roanoke River between South Boston, Va., and Roanoke Rapids.

With the dams, the river lost its seasonal rhythm. Before, at least once each year floods of 100,000 cubic feet per second (cfs) would surge and recede in a matter of days. Now the big floods are held back, and the water released slowly, to meet the people's demand for electricity and steady lake levels. Because the water is released slowly, it stays high longer. Releases of 20,000 to 35,000 cfs put 5 or 6 feet of water back in the swamps for months at a time. After Hurricane Fran, the swamps were covered for five straight months. The ecosystem is adapted to periodic flooding, but not to prolonged high water year after year. The strain is showing.

Below Hamilton, Rainbow Banks rises 70 feet straight up on the west side of the river. At the top, Confederate engineers placed Fort Branch to guard the river and the Weldon-to-Wilmington Railroad from Union forces who had captured Plymouth. Old gun emplacements still point toward an S-curve in the river and the low bank opposite. A well-shot cannonball might have landed right in the Roanoke River Refuge.

Jerry Holloman, Fish and Wildlife Service biologist Jean Richter, and I arrived by boat instead. It was an easy scramble up the embankment on this side. The broad natural levee gradually descended toward a backswamp. We passed swamp chestnut, green ash and overcup oak. Old logging canals cut through the swamp. Bald cypress stumps 6 to 8



SCOTTY LOVETT

The Roanoke's deer and turkey populations have long been legendary among the area's sportsmen, but many other wildlife species also use the river basin. Mary Kay Clark (bottom, left) of the state Natural Sciences Museum in Raleigh searches a den tree in a Bertie County swamp for the eastern big-eared bat.

feet in diameter told why. Nearly all of the mature cypress were harvested years ago. Many tupelo gum trees remain, but only in the distance did we see clumps of 30-year-old cypress.

The walking was easy, too easy, but not because it was dry. The forest floor was so clear of understory that Holloman and Richter paused by two cypress sprouts to debate their age. One, they decided, was this year's seedling, the other, a sapling that sprouted after last spring's flood. It will take another dry year to give these guys a chance at survival, they said. Although adult cypress thrive with wet feet, young trees need at least a three-year dry spell to sprout and grow tall enough to keep their heads above water in a prolonged flood.

Before the dams were built, periodic dry spells were part of the natural rhythm of the water. Now the dams hold back the big floods and release water slowly. Because the water is released slowly, it stays high longer, covering the swamps for months at a time. Watermarks on trees at Broadneck Swamp tell the story. Watermarks on the surrounding trees explained their concern. When the dams release water at 19,000 cfs, the river floods the swamp 4½ feet deep. A release of 35,000 cfs raises the water to nearly 6 feet. With little relief from the flooding, young cypress are drowning at Broadneck and in other swamps all along the river.

The other extreme in nature's cycle also has been disrupted. Historically, about once a year a flood of 100,000 cfs would surge and recede in a matter of days. These massive floods inundated the floodplain and preserved it for wetland species. Today, no more than 35,000 cfs flows down the river, not enough to cover the entire floodplain. As a result, trees adapted to drier regimes are showing up on some of the higher elevations —beech trees and hollies on swamp ridges, red maples on marsh grass terraces.

"It's basically a system under stress," said Sam Pearsall, The Nature Conservancy's North Carolina director for science and stewardship. Consultants for the conservancy are testing computer

models that would adjust the dam releases so that the river could return to more natural flow conditions without harming the lakes or cutting into electric generation. Pearsall acknowledged that it may be a hard sell for upstream neighbors.

The Nature Conservancy and its conservation partners have been studying the effects of prolonged flooding and trying to come up with alternatives. Currently, among species downstream, only the striped bass is taken into account in the management of the dams. But what's good for striped bass isn't always good for other parts of the ecosystem.

"One of the most difficult challenges is to accept the fact that we can't plan for an optimum year," Pearsall said. "There's no such thing as a year that's perfect for everything. Nature handles this by giving us a couple of good years for one species, then the other. Nature optimizes over centuries. We have to do the same so none is served at the expense of the others."

Bringing upstream neighbors onboard will present another challenge. The Corps of Engineers says it needs a congressional appropriation for an environmental impact statement; Virginia Power naturally looks askance at anything likely to decrease electric generation; and lakefront property owners want to keep water lapping on their beaches. Consultants for The Nature Conservancy are testing computer models for water releases they think will answer most concerns. Even so, Pearsall knows any change will meet resistance.

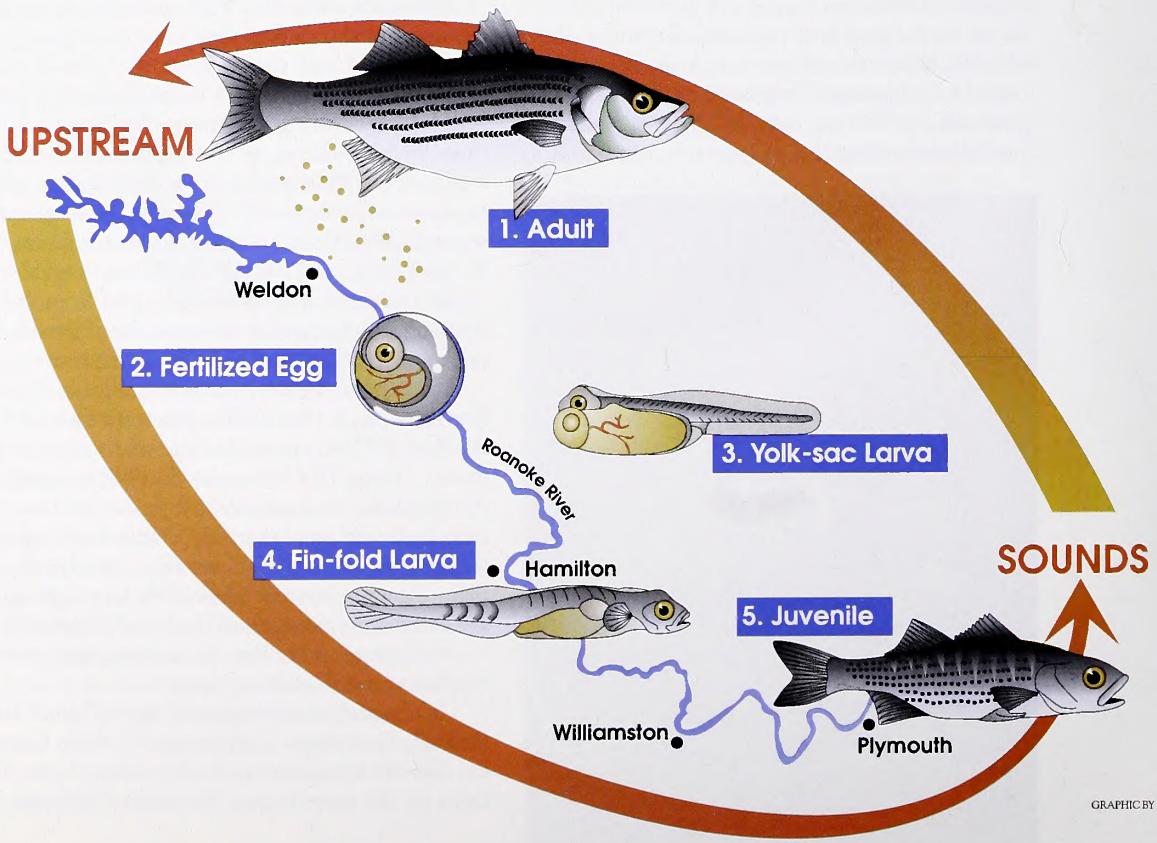
"One of the problems is, the floodplain looks beautiful," he said. "Nowhere is it unattractively damaged."

Certainly, nothing was unattractively damaged last January when just below Williamston six canoes floated down Sweetwater Creek, one of the many streams that snake their way toward the Roanoke across the lowlands of Bertie and Martin counties. As the water spread out across the swamp, so did the canoes. For a while we passed occasional parties of duck hunters, but slowly we left behind the boom of shotguns and the hum of highway traffic.

With nothing to shade it, the flat, black water perfectly mirrored the scene around us. Whether we looked up or down, cypress and tupelo towered against the sky, their knees rising from the water like praying hands. Wood ducks and Canada geese filed by quietly. A group of deer, startled by our presence, splashed off. Then silence reigned again. Nature's cathedral, I thought. Off in the distance, a barred owl hooted "amen."

The Roanoke is a birder's paradise. Surveys have documented 214 species of birds in the floodplain, including 88 resident breeding species, the highest density of nesting birds anywhere in the state. Fourteen species of migratory fowl use the wetlands in winter—mallards, goldeneye, teal and black ducks among them. Come spring, herons, egrets and cormorants fill cavities and tree tops. The Roanoke supports at least six

STRIPED BASS Life Cycle



GRAPHIC BY ERIN HANCOCK

***Like other** anadromous fish, striped bass migrate up the Roanoke River in spring to spawn near Weldon (1). A single fish can release as many as a million fertilized eggs (2) which will float downstream to hatch near Hamilton. As the eggs develop into larvae, they continue to flow downstream, reaching yolk-sac stage (3) near Williamston and fin-fold stage (4) near Plymouth. Finally, a young of the year or juvenile striper (5) reaches the Albemarle Sound where it will spend the year feeding and growing.*

ROANOKE'S Striped Bass

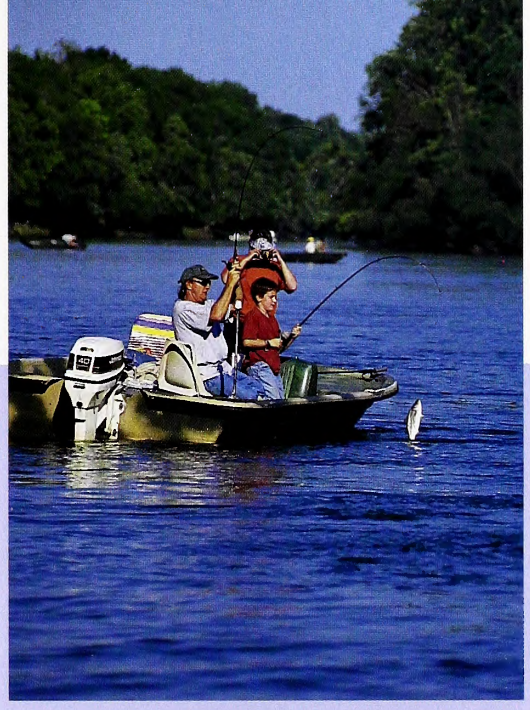
Jack Eudy cut the motor on his flat-bottomed boat and cast a line one morning last April. Within seconds, he hauled out a 3-pound striped bass. As fast as he released one fish, he caught another, a 5-pounder this time.

"You can just catch 'em all day," said Eudy, one of five full-time fishing guides based in Weldon. "This is the greatest comeback story there's ever been, and now all those shad are coming back."

If Eudy exaggerates, he's still in the ballpark, and it's no exaggeration at all to say that striped bass—also known as stripers, rockfish and rock—have made the Roanoke River famous. They spend most of their lives in the waters of the Albemarle Sound, but every spring the urge to spawn on their natal ground triggers a mass migration through the Albemarle Sound and up the river to the base of the rapids. And as surely as the bass run, the fishermen follow. On the last Saturday of the season, enforcement officers counted 500 boat trailers parked between Williamston and Plymouth. Even on a weekday when regulations allowed only catch-and-release fishing, the lot at the Weldon boat ramp overflowed. Some of Eudy's clients this year came from Georgia, Maryland, Oregon and Massachusetts.

Twenty years ago, this scene appeared to be in serious jeopardy. The striped bass population had crashed. Over the next dozen years, scientists conducted study after study to find the cause. One group examining the flow of the river negotiated to change the way water was being released from the upstream dams so that, at least during spawning season, the flow would mimic predam conditions. (Striped bass need flowing water to keep their eggs suspended, but too much water washes the eggs downstream too fast, and sudden, large releases of cold water cause them to stop spawning altogether.) Meanwhile, the state also instituted a series of restrictions on commercial and recreational fishing, from closed seasons to quotas, size limits and a requirement for barbless hooks, which increase the survival chances of stripers that are caught and released.

The efforts began to pay off in the late '80s, and in 1997, the Atlantic States Marine Fisheries Commission declared the Roanoke River striped bass stock officially recovered. Quotas for 1999 were set at 69,000 pounds for hook-and-line sportsmen in the river and 140,000 pounds for commercial fishermen in the sound.



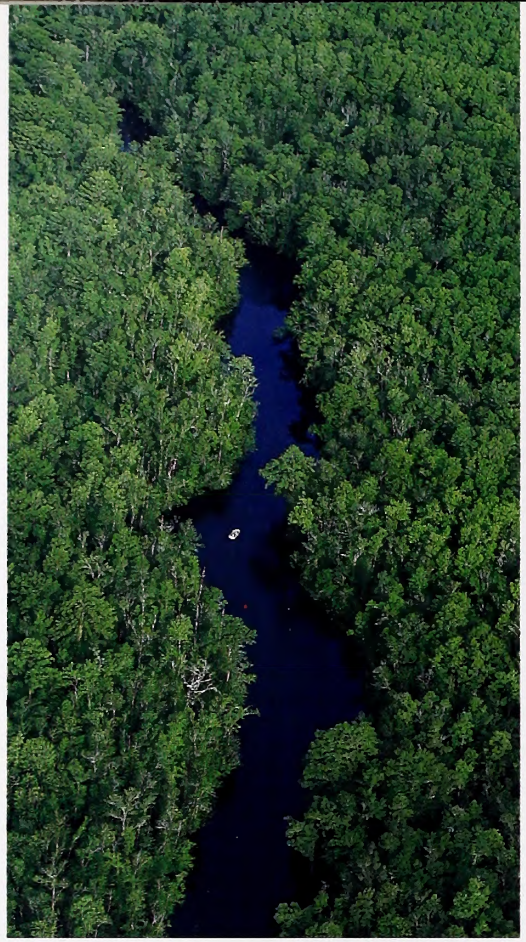
***With striped** bass populations on the Roanoke declared recovered, thousands of anglers gather on the river to catch spawning rockfish in a centuries-old rite of spring.*

"Our data indicate the total numbers have reached historical levels," said James "Pete" Kornegay, a fisheries biologist with the Wildlife Commission. "We probably have as many fish as we've had in the last century, but the age composition is different. They're relatively young. Just in the past two years, we've started seeing older fish spawning, fish that are 10 years old or more. We're also seeing fish larger than 27 inches. That's what we're after."

Other anadromous species (that is, those saltwater fish that swim upriver to spawn) have long shared the Roanoke and the affection of fishermen. Those fish have suffered alongside stripers. Now, the hickory shad population appears to be rebounding. American shad and sturgeon are in more serious trouble, but some signs are hopeful. The fisheries division has begun a new, long-term restocking program for American shad, and sturgeon—including the federally endangered short-nose sturgeon—recently were documented in the river for the first time since 1884. "We're very, very encouraged that there may still be a spawning population in the Roanoke River," Kornegay said.

Nothing can be taken for granted, however. Serious issues continue to challenge the future of anadromous fish and their kin residing in the Roanoke year-round. The prospect of a major new industry locating on the river near Weldon raised considerable alarm among biologists and fishermen earlier this year. Downriver, concerns focus on water-quality issues, such as the presence of cancer-causing dioxins and the periodic depletion of dissolved oxygen, which leaves fish gasping for air.

Meanwhile, an economic study is trying to put a dollar figure on the Roanoke's sport-fishing industry. One of the earliest results suggested that sport fishermen pump as much as $1 million into area economies during striped bass season. And that, Kornegay said, "is just one species for 75 days in spring."



***The vast** Roanoke River valley can still swallow up a small boat and its passengers.*

***Near the Chockoyotte Aqueduct,** members of several groups working on behalf of the Roanoke River gather. Front row, from left: Chris Wicker and Charles N. "Poochie" Fitts, Roanoke Canal Commission; Kenneth Brantley, Roanoke River Basin Association; Jamey Gerlaugh, Roanoke River Partners. Back row, from left: Dan Brown, Roanoke River Basin Association; Gregg Camp, Roanoke Rapids Sanitary District; Suetta Scarbrough and Harold E. Carawan, Roanoke River Basin Association; Ross Steckley, Roanoke River Partners.*

active waterbird nesting rookeries, including the largest inland rookery in the state. Wildlife officials have estimated as many as 2,500 nesting pairs of waterbirds on Conine Island near Williamston, and this year, 26 pairs of yellow-crowned night herons nested on Broadneck Swamp.

In spring, neotropical migrants also return to nest, making the Roanoke floodplain a veritable songbird factory. So it was in May that Merrill Lynch and Jaime Collazo, a zoologist with the Cooperative Fish and Wildlife Research Unit and professor at N.C. State University, led an expedition to The Nature Conservancy's reserve at Devil's Gut, southeast of Williamston. Here was evidence of old meandering river channels as we crossed ridges and skirted soggy sloughs. In the sloughs, 700-year-old cypress rose 100 feet into the sky.

With each change in elevation, plant communities also changed. By creating such rich and diverse habitat, the bottomlands invite an equally rich community of birds. It's not only the canopy trees that are important, but also the understory's shrubs and grasses. "This habitat provides something for all," said Collazo, a lead investigator on a 10-year study of Roanoke River songbirds. "It's a mosaic of great diversity and productivity."

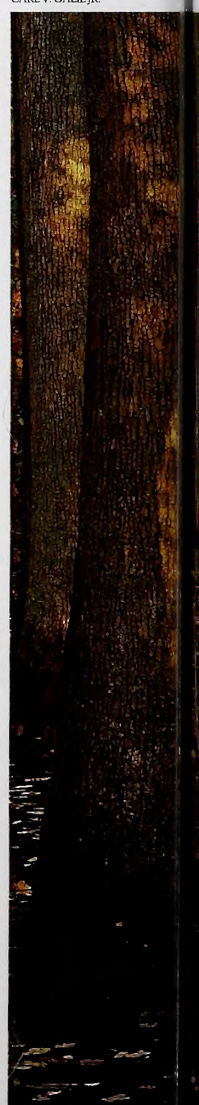
As he spoke, golden prothonotary warblers flitted in and out of small, head-high cavities. A great crested flycatcher kept his distance from a higher branch, yielding a view only of a yellow stomach and blue-gray neck. Scarlet and summer tanagers proved even more elusive. The experienced birders recognized their songs; the rest of us caught flashes of red.

Collazo is intrigued that species such as Acadian flycatchers and wood thrushes thrive on the Roanoke. In the Midwest and Northeast, these birds are associated with large tracts of deciduous forests. Instead of large tracts, in the Roanoke bottomlands they find a patchwork of smaller tracts where the forest shifts gradually from swamp to levee and back again. It may be that what they seek most is something both types of forest provide—protection from the cowbirds, jays and raccoons that invade the forest edges to prey on nests. But Collazo isn't ready to say for sure. "When you think you can make a generalization, that's when it falls apart," he said.

Other species that have declined elsewhere—the Swainson's and cerulean warblers, for example—occur on the Roanoke in relatively high abundance. Once again, I heard, all is not well in paradise. Outside of protected areas, clearcutting continues to displace birds and open the interiors of remaining forests to predators. Equally detrimental are the high waters that destroy the cover and forage habitat of ovenbirds, Swainson's warblers, Kentucky warblers and other ground nesters. "If the understory is reduced, the same level of predators may be more dangerous for bird productivity," Collazo said.

We had been talking of birds for some time when a steady, staccato rustling of the leaves overhead caught my ear. A warm May sun had bleached

CARL V. GALIE JR.



the sky when we entered the woods, and shafts of light still pierced the ground through openings in the canopy. If it wasn't the sound of rain, what?

Forest tent caterpillars were eating their fill, Lynch said. Within days, most of the trees would be bare.

You can hear caterpillars eating?

No, he said, but you can hear their feces dropping all around.

In answer to my disbelief, Collazo silently stuck out his hand, then held it up to me. In his palm lay a tiny black dot. Caterpillar dung. (Note to self: Next trip, wear hat.)

State wildlife officer Mike Hatcher convinced me not to try trekking onto Huff Island, part of the Bachelor's Bay Game Land. One year, mosquitoes chased out 75 bow hunters in a matter of hours, he said. It's more basin than island, really, with just a slight levee surrounding a soggy swamp. Hunters in the know prefer to anchor their boats and let dogs handle the legwork.

We rode wind-driven waves over the graveyard of ships sunk during the 1864 seige of Plymouth, past patches of marsh grass, lily pads and wood duck boxes, out to where the Roanoke, Middle and Cashie Rivers feed the sound. The stakes for a commercial fisherman's pound nets awaited the opening of next year's striped bass season. A different kind of fisherman flew overhead, its catch clutched in its talons.

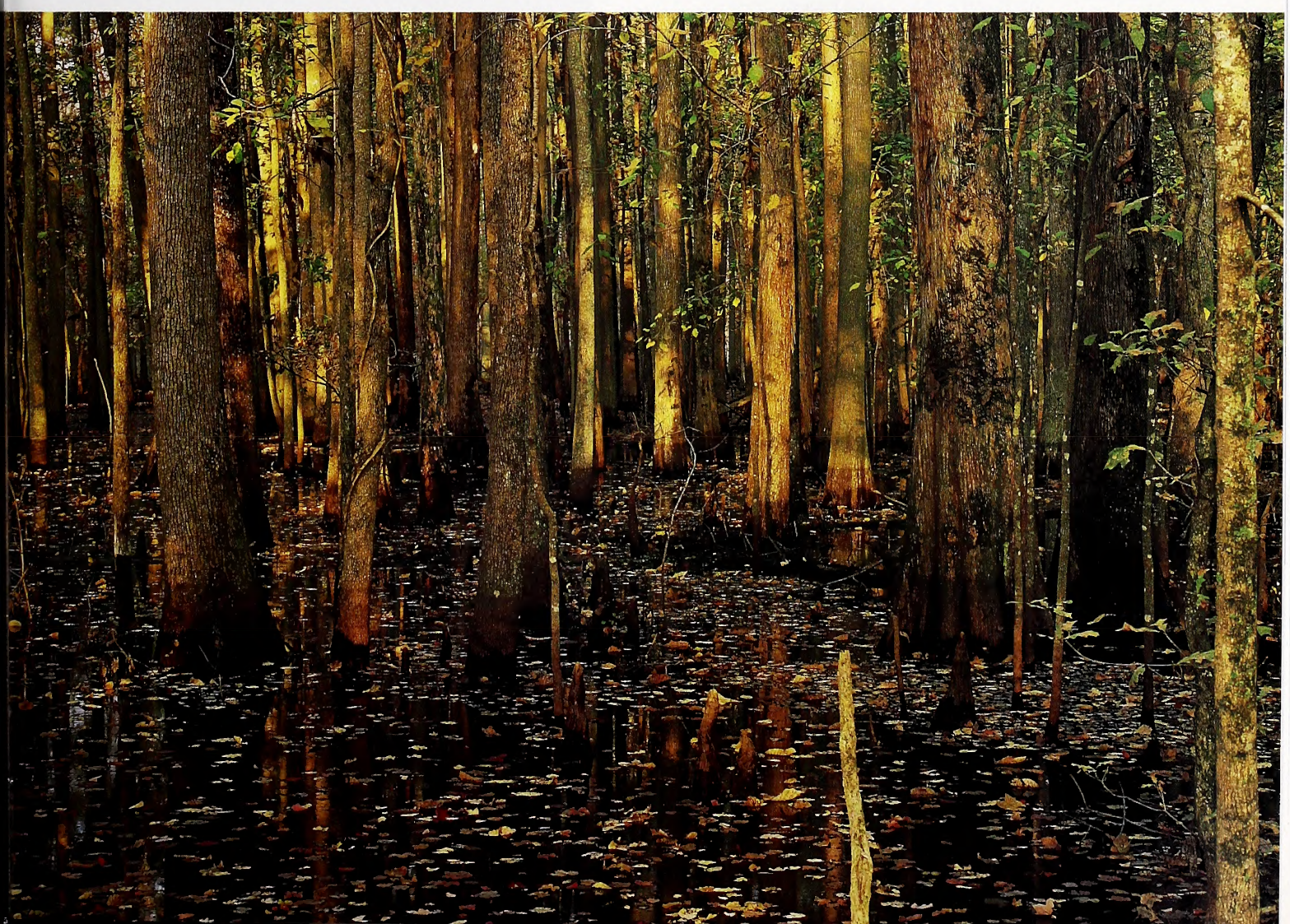
"I've never seen an osprey without a fish," Hatcher mused. "They always take their lunch with them." Once, though, he saw an eagle steal an osprey's lunch right out of its grasp.

That's a dangerous river," my aunt said, when I told her I planned to travel down the Roanoke. In her youth, she lived on a farm at Hill's Ferry, near Palmyra. She remembered the barges that used to bring fertilizer up the river and, more than that, the rushing current, the rising water, the drownings.

Centuries before, the Algonkian Indians seemed to share my aunt's view. "Moratock," they called the river. It meant death. But Moratock was also the name they gave the Tuscarora Indians who inhabited its banks. The fierce, warring Tuscarora.

"Roanoke," on the other hand, is merely a word that means the shell of a little mussel. Indians once used the mussels, sewn in elaborate patterns, to decorate their clothing.

In its turn, the Roanoke River has decorated the landscape with ridges and swales, towering cypress and delicate *Camassia*, black bears and hummingbirds. With 356 species of moths and the eastern big-eared bat. With elusive bobcats and marsh rabbits. With turkey vultures and beavers. To this rich and diverse land, the eagle has returned. So will I. ⊠



***Devil's Gut** Natural Area, on the lower Roanoke, contains centuries-old bald cypress and tupelo trees. The site is owned by the North Carolina chapter of The Nature Conservancy.*

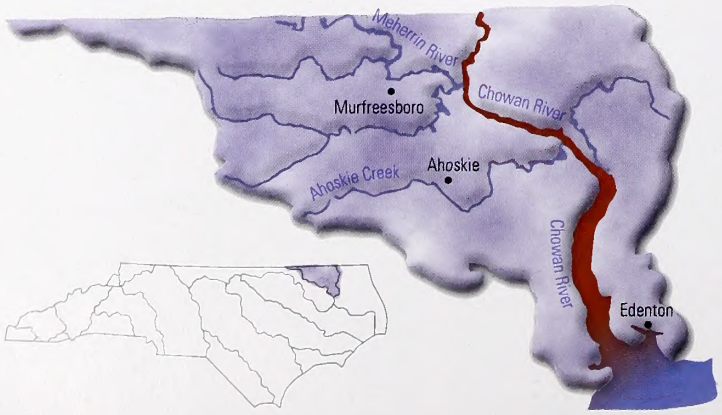
Patience PAYS OFF

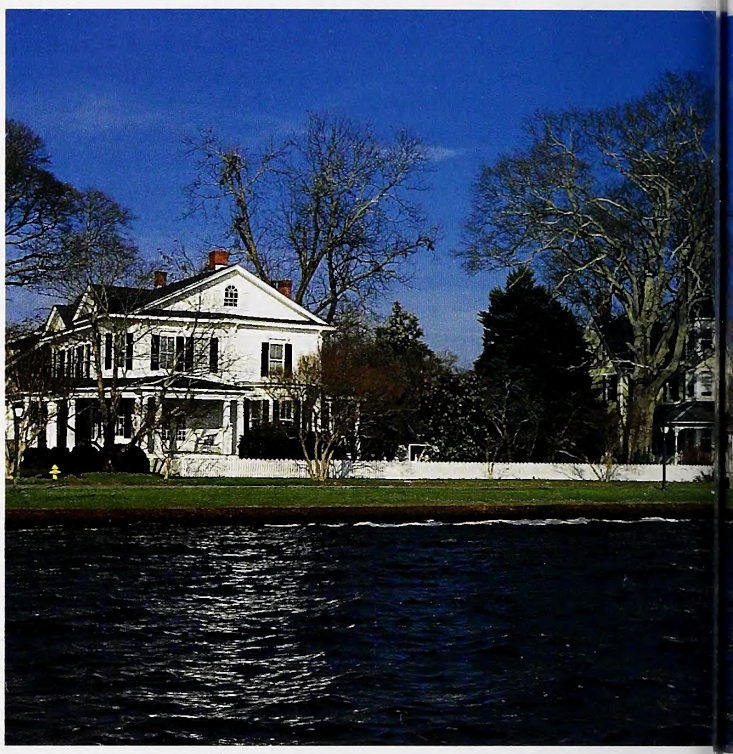
The Chowan River begins in southeastern Virginia at the confluence of the Nottaway and Blackwater rivers. Once in North Carolina, the river flows southeast, past small towns like Winton and Colerain, to Edenton, where it pours more than 1 trillion gallons of fresh water into Albemarle Sound every year.

Cypress trees wade knee-deep in the river and bright sun makes the water sparkle. But for decades, high nutrient levels in the Chowan caused severe outbreaks of algae, fish kills and fish disease, marring the river's rural beauty.

The worst blooms of blue-green algae were reported in the lower portions of the river in 1972 and 1978, when warm, dry summers followed high spring flows. The 1972 bloom concentrated near Colerain and lasted from June to August. Conditions were so severe that one newspaper described the bloom as "gangrenous velvet blanketing the river." By October, the *Winston-Salem Journal* declared the river dead.

By the late 1970s, the massive growths had expanded to cover more than a 20-mile stretch of the river, from Holiday Island to below Edenton. Fishermen feared for their livelihood and riverside residents were outraged. During several summer fish kills, it seemed possible to walk across the dead bass and catfish on the surface of the river. Volunteer groups formed to raise awareness of the problem and to search for solutions.



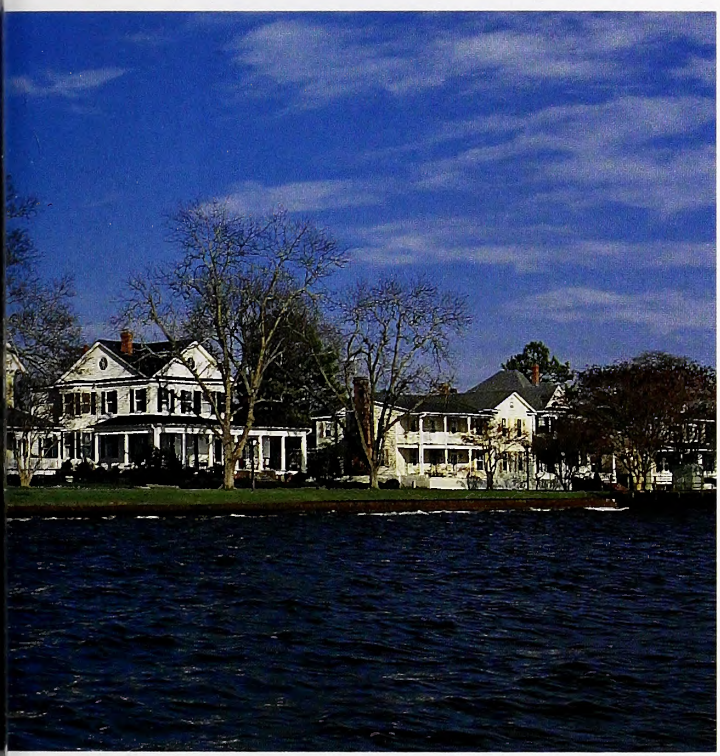


***Situated near** the mouth of the Chowan River, historic Edenton has benefited from the reduction of nutrients and other pollution in the river over the past two decades. Once plagued by algae blooms and fish kills, the cleaned-up waters of the Chowan now attract tourists and fishermen (right) alike.*

Retired Navy Capt. Alfred Howard moved to Edenton in 1974, and he quickly realized that something was wrong with the river. "It was in pretty bad shape," Howard says. "It stank like an open sore." When the blooms of algae were thriving, the surface of the water was a thick green sludge that rarely cleared. "At the blue stage, it would stain swimsuits. It left green and blue collars on the piers and pound net stakes, and a blue smear along the beach where it met the water."

Homeowners in the Arrowhead community, where Howard lives, signed on with the Stream Watch program, which helps residents to "adopt" a waterway and act on its behalf. The new volunteers gathered information about the water quality, ecology and history of the Chowan, and they purchased a water-quality test kit to monitor the river's health.

Armed with information, the Arrowhead residents began publicizing the river's plight and encouraging others to get involved. Group members also attended public hearings for National Pollutant Discharge Elimination System (NPDES) permits, which industries and treatment plants



MELISSA McGAW

must maintain in order to discharge wastewater. If the Arrowhead group believed that businesses were not abiding by the regulations required to maintain the permit, they spoke up about it at the hearings.

Patrick Stanforth, former director of the Albemarle-Pamlico Citizens Water Quality Monitoring Program, has only high praise for Howard and his group. "With Captain Al there, we know the Chowan is in good hands.... I couldn't pick a better advocate for the river."

Scientists also rallied to defend the Chowan. North Carolina Sea Grant and the Water Resources Research Institute focused extensive research efforts on river and estuarine processes. A decade of work led scientists to conclude that controls of both nitrogen and phosphorus were necessary to reduce the frequency and magnitude of algal blooms in the river. They provided the state with specific guidelines for reducing these nutrients.

In response to these guidelines and continued volunteer efforts, the state passed a series of breakthrough environmental regulations over the next two decades. The 1979 Nutrient Sensitive Water classification placed nutrient limits on wastewater treatment plants discharging to the Chowan. The Chowan/Albemarle Action Plan and the Chowan River Water Quality Management Plan of 1982 also called for pollution reduction.

Farmers got involved in 1985 when the state funded the Agricultural Cost Share Program, which provided technical and financial assistance to farmers who tested their soil, used conservation tillage, split applications of fertilizer and established grass in waterways and field borders.

The happy results of all this co-operation? Researchers estimate that 123,244 tons of soil erosion have been prevented annually. Forty-eight million gallons of animal waste have been applied to crops rather than stockpiled in feedlots or lagoons.

Today, the Chowan River is a lot healthier than it was in the 1970s. Algal blooms are less frequent, and they don't last as long. Tourism thrives in Edenton. Striped bass and white perch fisheries have improved steadily since the early 1980s.

Volunteers from the Arrowhead Property Owners Association continue to monitor the water and collect data, but they are much happier with the river's health. "Last summer was beautiful," says Howard.

Scientists and regulators are also pleased with their progress, and from the banks of the Chowan it is easy to see why. Spanish moss hangs from the trees overhead, and the spreading branches are reflected in water the color of good sweet tea. Ducks dot the river's surface.

The Chowan's rebirth teaches us patience and hope. Given time, we can clean up anything.—*Renée Wolcott Shannon and Barbara A. Doll*

CHOWAN RIVER BASIN **FACTS**

Atlantic drainage

Size of N.C. watershed: 1,315 square miles

Total streams and rivers: 788 miles

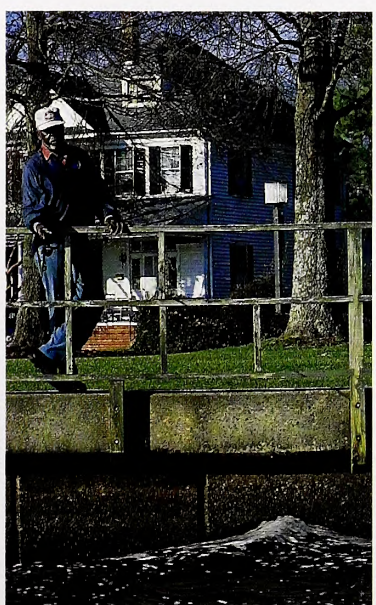
Major tributaries: Meherrin, Upper Chowan, Middle Chowan rivers; Potecasi and Ahoskie creeks

Municipalities: 18

Population: 62,474 (1990)

Major land use: Forest

States flow through: Va., N.C.



MELISSA McGAW

RIVER of the Eastern Wildlands

The Alligator River, in northeastern North Carolina, is located on the eastern end of the vast Pamlimarle Peninsula, bordered on the north by Albemarle Sound, on the east by Croatan Sound, and on the east and south by Pamlico Sound. The Alligator is probably one of the least known of our rivers simply because it is located in one of the wildest and remotest parts of the state. Most people only see the river as they speed over the four-mile-long U.S. Highway 64 bridge on their way to the Outer Banks. Perhaps because of its low profile, the Alligator River is still a wild body of water that flows through a landscape that has changed relatively little since the days when Native Americans paddled and fished its waters.

KEN TAYLOR

Less than 50 miles long, the Alligator has no settlements along its entire course. One would be hard pressed to find any human artifact along its entire shoreline save the occasional buoy, fishing nets or dilapidated shack. The headwaters of the Alligator River flow from Alligator Lake (shown on state road maps as New Lake), one of our few natural lakes, one of the shallowest (an average depth of only 3 feet) and one of the wildest (black bears outnumber humans here three to one).

At a majestic altitude of 10 feet above sea level, the Alligator (New) Lake fork of the Alligator River begins its slow journey to Albemarle Sound as an inconspicuous channel meandering through a thick swamp forest. For the first few miles, the river flows through a dense swamp, barely wide enough for a canoe, in a natural landscape interrupted by only one road and bridge (N.C. Highway 94). Downstream from the N.C. 94 bridge the river widens and joins its twin fork, the Northwest Fork, near the remote Gum Neck community in Tyrrell County.

A few miles downstream, the river suddenly changes from a winding channel to a broad body of water 4 to 5 miles across that seems more like an arm of the sound than a river. Along this stretch the river passes various tributary streams with picturesque names such as Whipping Creek, The Frying Pan and Milltail Creek. How different from the little swamp stream just 15 miles or so upstream!

The Alligator River watershed contains a number of different vegetation types. Several different types of pocosin are present, all of which are characterized by the presence of pond pine, the abundance of broad-leaved evergreen shrubs and by the dense, impenetrable nature of the vegetation. The vegetation types also share another characteristic—they directly or indirectly depend on periodic fires to maintain their habitat. One type, known as low pocosin, only occurs in areas where the peat is at least 4 feet thick. Another distinctive type, peatland Atlantic white cedar forest, is dominated by almost pure stands of the cedar, known locally as juniper, which was heavily cut for its prized timber used for ship-building and shingles. This endangered natural community once covered hundreds of thousands of acres in North Carolina, but has been reduced to less than 2 percent of its original acreage by timbering operations and the destruction of the pocosin ecosystem. The Alligator River peatlands shelter more than 80 percent of the remaining white cedar acreage in the state.

In areas sheltered from frequent fires and with slightly more fertile soil, the nonriverine swamp forest occurs. It is characterized by stands of bald

PASQUOTANK RIVER BASIN FACTS

- Atlantic drainage
- Size of N.C. watershed: 3,697 square miles
- Total streams and rivers: 479 miles
- Major tributaries: Currituck, Croatan and Roanoke sounds; Pasquotank, Alligator, Perquimans, Little, Yeopim, Scuppernong, North rivers; Phelps Lake
- Municipalities: 1
- Population: 97,215 (1990)
- Major land use: Agriculture
- States flow through: Va., N.C

cypress, swamp blackgum, along with other species such as red maple and Atlantic white cedar. Another distinctive vegetation type known as canebrakes once formed huge stands that stretched for miles across the landscape. These canebrakes, composed of a giant woody grass known as giant cane, were created and maintained by frequent lightning-caused fires that once swept across portions of the peatland landscape. Early settlers described these canebrakes as "a green sea stretching to the horizon." The now extinct Bachman's warbler is believed to have been restricted primarily to this type of habitat, and its demise is most likely related to the elimination of the canebrakes.

Today a world-class ecological reserve encompassing more than 530 square miles, almost all of it within the Alligator River watershed, is protected by the Alligator River National Wildlife Refuge and the Pocosin Lakes National Wildlife Refuge, by the Dare Bombing Range and by state-owned conservation lands around Phelps Lake and on the Alligator River. This block of habitat is big enough to maintain populations of large mammals such as black bears and red wolves.

The Alligator River is the home of the northernmost population of American alligators in the United States. The vast swamp forests and pocosin habitats are also very important breeding grounds for a number of neotropical songbirds including 13 species of wood warblers, such as the black-throated green warbler.

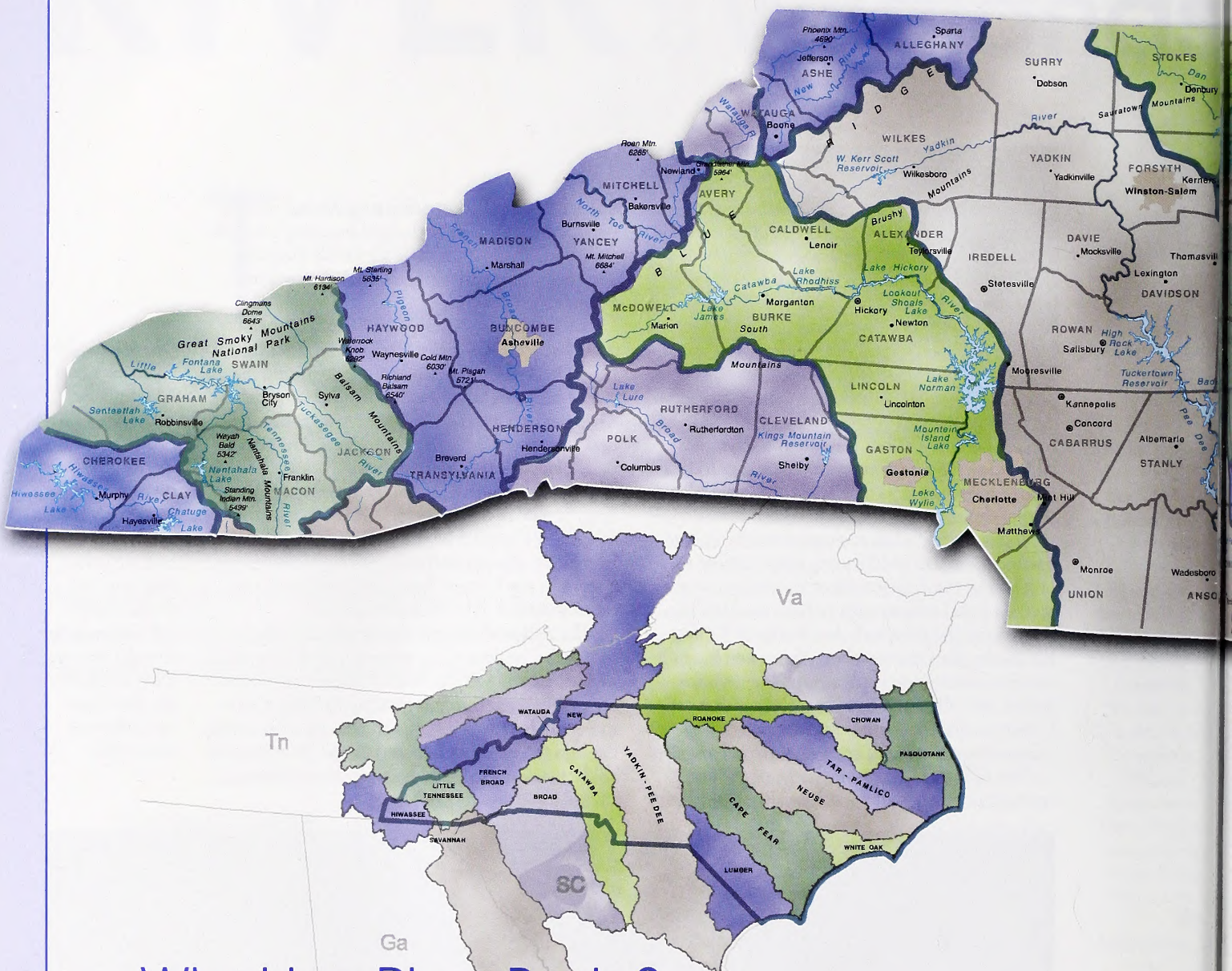
The waters of the Alligator River have been designated as Outstanding Resource Waters by the N.C. Division of Water Quality, recognizing the river's pristine condition and high water quality. The river and its tributaries are recognized as a major spawning area for anadromous fish, principally blueback herring and alewife, collectively known as river herring. And finally, the Alligator River is part of the Albemarle-Pamlico Estuarine System, recognized by the U.S. Environmental Protection Agency as the second largest estuarine system in the United States with nationally significant aquatic and wetland resources.

The Alligator River is one of the best places in North Carolina to experience a river ecosystem in a wilderness setting. Bears, bobcats and wolves are all here and thriving. And where else in this increasingly crowded state can you spend an entire day and see no other human beings? Freedom and wilderness can be found here for those wishing to find it.—*Merrill Lynch*

***One of** the state's wildest places, the Alligator River and its surrounding swamp forests offer refuge to a rich diversity of wildlife including neotropical songbirds, red wolves, black bears and, of course, alligators. The one thing missing is humans in this wildlife paradise where bears outnumber man three to one.*

KEN TAYLOR

North Carolina's



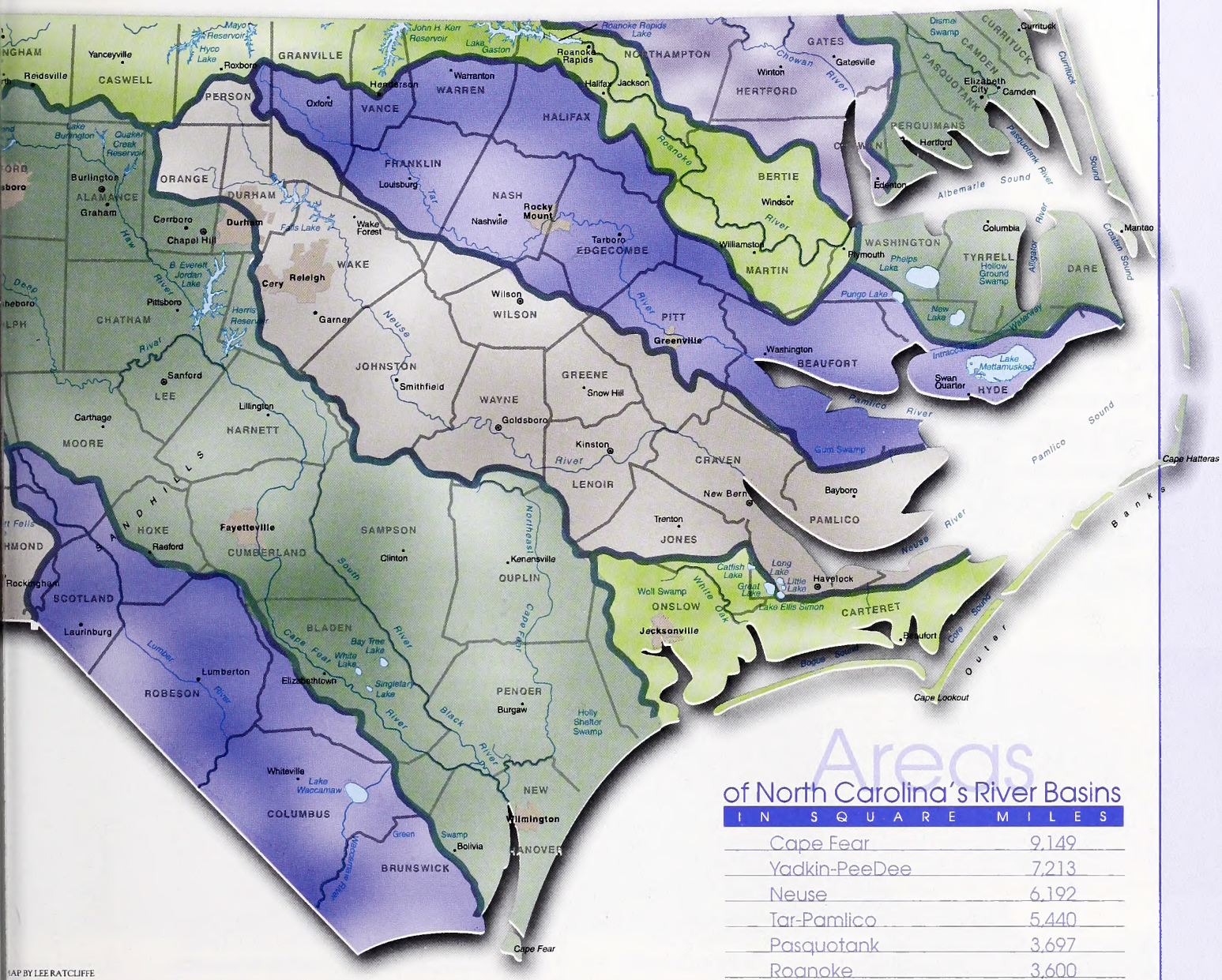
What Is a River Basin?

A river basin encompasses all the land surface drained by many finger-like streams and creeks flowing downhill into one another and eventually into one river, which forms its artery and backbone. As a bathtub catches all the water that falls within its sides and directs the water out its drain, a river basin sends all the water falling within its surrounding ridges into its system of creeks and streams to gurgle and splash downhill into its river and out to the ocean.

The shape of a river basin comes from the collective and opposing forces of mountain-building and weathering. Geological forces push mountains up into the sky, and weathering from rain and wind wears mountainsides into hillsides and valleys and plains. A jigsaw puzzle of river basins reflects in three dimensions the outcome of these combined forces molding the landscape.

As an artery connects the parts of a body to one another, so a river threads together the creeks and streams, valleys and hills, springs and lakes that share a common assembly of water. What happens to the surface or underground water in one part of the river basin will find its way to other parts. If water is diverted out of its usual course in one part of a river basin, other parts will know its absence. A river basin comes closer than any other defined area of land, with the exception of an isolated island, to meeting the definition of an ecosystem in which all things are connected and interdependent.

River Basins



MAP BY LEE RATCLIFFE

SOURCES: SCHOOL OF DESIGN, N.C. STATE UNIVERSITY; N.C. DIVISION OF WATER QUALITY; N.C. OFFICE OF ENVIRONMENTAL EDUCATION; N.C. DEPARTMENT OF TRANSPORTATION.

Areas of North Carolina's River Basins

IN SQUARE MILES	
Cape Fear	9,149
Yadkin-PeeDee	7,213
Neuse	6,192
Tar-Pamlico	5,440
Pasquotank	3,697
Roanoke	3,600
Lumber	3,336
Catawba	3,274
French Broad	2,842
Little Tennessee	1,800
Broad	1,506
Chowan	1,315
White Oak	1,233
New	765
Hiwassee	640
Watauga	184
Savannah	151
Amazon*	2,300,000
Mississippi*	1,240,000

*for comparison

Know Your River Basin!

Explore the Division of Water Quality's web site for its Basinwide Planning Program: http://h2o.enr.state.nc.us/basinwide/basinwide/default.htm. For each of North Carolina's 17 river basins, you'll find a basinwide plan, river statistics and other information.

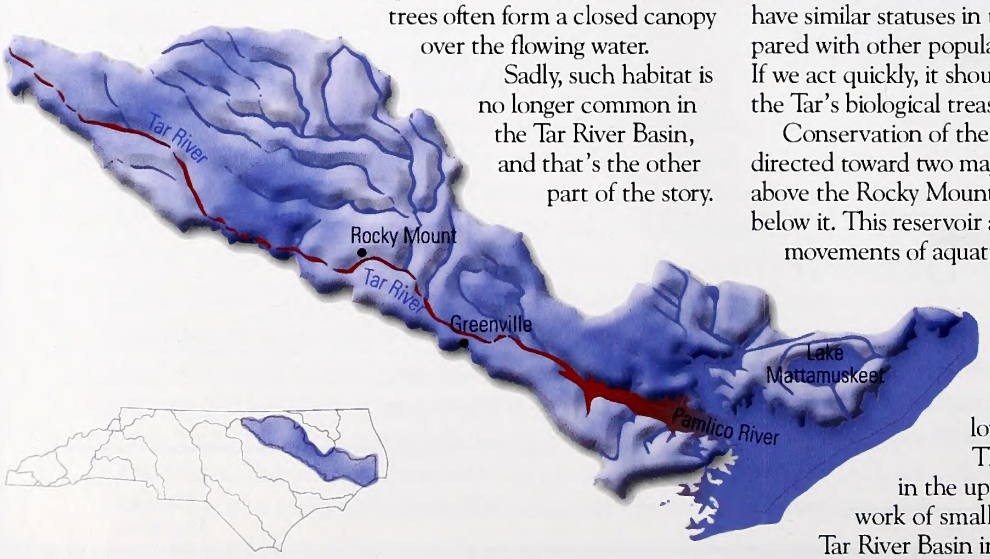
TREASURES of the UPPER Tar

When I started my career as a field biologist with the N.C. Wildlife Resources Commission in 1986, my first assignment was to complete a survey of the Tar River spinymussel, a federally listed endangered fresh-water mussel species. Since I had been given a week's training in the Tar River by some of our best biologists, I considered myself worthy of the task. Back in the early '70s and '80s, the spinymussel had been relatively easy to find in the Tar River near Louisburg and upriver from Greenville.

I thought: *this won't be difficult*. Off I went, surveying station after station in many, many areas of the Tar River Basin. In nearly a year of work, I found a single Tar River spinymussel near Tarboro.

Part of the moral of the story is that humility is a virtue. The Tar River spinymussel is very difficult to find under the best of circumstances. It's very much a habitat specialist, its preferred habitats coarse sand and gravel beds in relatively fast-flowing, clean creeks and rivers. These habitats are usually associated with extensive woodlands. Streambanks are stabilized by interlocking root systems produced by mature trees. The trees often form a closed canopy over the flowing water.

Sadly, such habitat is no longer common in the Tar River Basin, and that's the other part of the story.



Of all North Carolina's river basins, the Tar has the highest rates of erosion and sedimentation. Sediment flowing into the Tar has smothered most good spinymussel habitat at various times over the past centuries. The sedimentation during recent decades, along with excessive nutrient loading from farms and cities and introductions of toxic substances such as heavy metals and pesticides, has further reduced spinymussel numbers. As with so many habitat specialists, the Tar River spinymussel is now critically endangered. In the main channel of the Tar River, this species is now only occasionally found near Tarboro, and reproducing populations only occur in small areas of Swift and Fishing creeks.

However, there is hope for the Tar and its many fascinating animals. One species of freshwater mussel, the Atlantic pigtoe, helps put this into perspective. The Atlantic pigtoe was once a very common species in rivers that drain into the Atlantic from Georgia to Virginia. Now, only one creek population exists in all of Georgia. All populations have been lost from South Carolina. Virginia's populations are mostly small, isolated and very vulnerable to extirpation. Most North Carolina Atlantic pigtoe populations are in similar straits.

However, three Tar River populations—the Tar River population in Granville County and those found in Fishing and Swift creeks—are reproducing and appear viable now. Other mussel species, such as the yellow lance and yellow lampmussel, have similar statuses in the Tar River Basin compared with other populations within their ranges. If we act quickly, it should be possible to conserve the Tar's biological treasures.

Conservation of the Tar's diversity must be directed toward two major focus areas—the basin above the Rocky Mount Reservoir and the basin below it. This reservoir acts as a major barrier to movements of aquatic animals between the upper and lower areas of the Tar River Basin. Luckily, there are refuge areas for aquatic species in both the upper and lower focus areas.

The most important refuge in the upper focus area is the network of small creeks in the Upper Tar River Basin in Person and Granville

TAR-PAMLICO RIVER BASIN FACTS

Atlantic drainage

Size of watershed: 5,440 sq. miles

Total streams and rivers: 2,355 miles

Major tributaries: Tar, Pamlico and Pungo rivers; Swift, Fishing and Tranters creeks; Cokey Swamp

Municipalities: 5

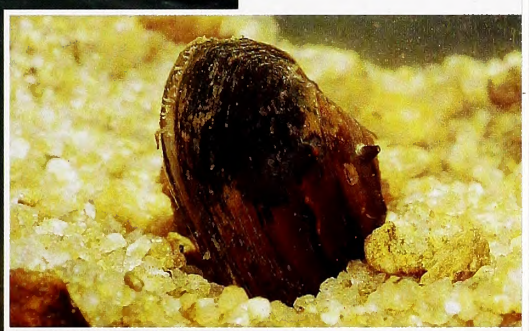
Population: 364,862 (1990)

Major land use: Forest/Wetland

States flow through: N.C.

KEN TAYLOR

The Granville County segment of the Tar River (left) is one of the last strongholds for the federally endangered Tar River spinymussel (below). Of all North Carolina's river basins, the Tar has the highest rates of erosion and sedimentation, which have gradually smothered most good spinymussel habitat.

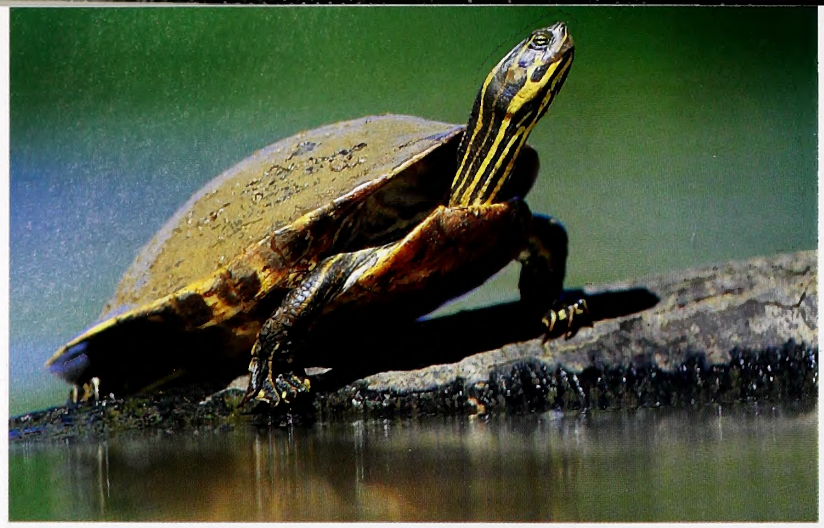


KEN TAYLOR

counties. Swift and Fishing creeks, which flow into the Tar River near Tarboro, are the primary refuge areas in the lower focus area. These refuges provide habitat for hundreds of common and endangered aquatic species, some of which—the Neuse River waterdog, Carolina madtom, North Carolina spiny crayfish and the Tar River spinymussel—are endemic or restricted to the Tar and Neuse river basins. These species and many of their associates were once found throughout the Tar River Basin. By conserving the refuge areas and improving habitats elsewhere, we can help rare and sensitive species repopulate extensive unoccupied habitats in each of the focus areas. These are long-term goals of the Wildlife Commission and many landowners throughout the basin.

One of the most important ways landowners can improve aquatic habitats in the Tar River Basin is to conserve and expand their woodlands near aquatic habitats. Recently, Champion International Corp. has agreed to use special management practices along 32 miles of its lands in the upper Tar River Basin. Riparian buffers will be a minimum of 200 feet wide. A no-harvest zone will be at least 50 feet wide, and limited harvesting may occur throughout the remaining buffer. Champion considers such a prescription to be "reasonable," and the corporation is working with other landowners in the basin to implement this approach to help restore the Tar.

In time, maybe the Tuscaroras' name for the river—Tau, or "River of Healthful Water"—will again be appropriate.—*John Alderman*



A yellow-bellied *slider basks in the sun to warm itself.*

KINGDOMS

of the STREAM

photographed by Derrick Hamrick

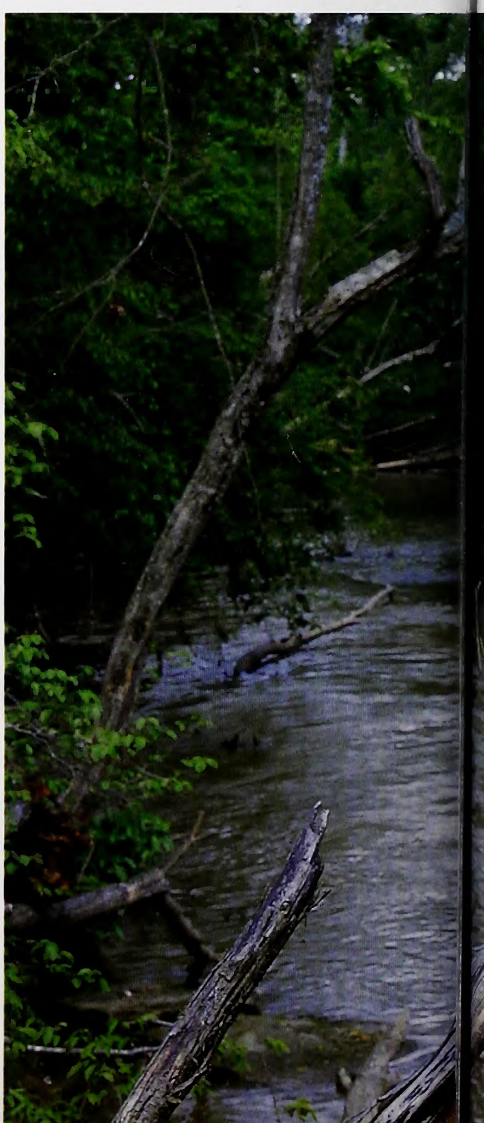
A stream is a single kingdom with many kings. Whether clad in scales, feathers or fur, each species claims a sovereign domain of its own, yet all take part in a common habitat that stretches from stream bottom to tree top.

***River otters** hunt for fish, finding common cause with other fish-loving species like ourselves.*

***This nesting** red-shouldered hawk finds a Neuse River bottomland perfect to bring up her young.*

When the *wood duck chicks are hatched, they'll almost immediately join their mother on the stream below.*

A river is a museum with countless hidden works of art. For every deer glimpsed daintily crossing a stream, a hundred other species carry on their secret lives unobserved.



A rough *green snake clings to the shrubs and trees above the stream margins.*

***Though not** very big, the minnow this kingfisher has found will fill its gullet.*

The Fight for the River of Peace

Named after the Indian tribe Neusiok, which means "peace," the Neuse River has a history of not living up to its namesake. Indians once traveled warpaths along its banks; Confederate and Union forces skirmished to hold or take its strategic points. Today, a different type of battle is occurring over the Neuse River. Concerned citizens and a reinvigorated N.C. Department of Environment and Natural Resources are fighting to reverse the effects of the river's decade-long decline.

written by
Chris Powell

photographed
by Ken Taylor

"Riverkeeper," answers Rick Dove, speaking into a cellular phone, over the whine of an outboard engine. On the other end of the line is yet another reporter frantically trying to get a quote or line up an interview, on deadline.

It's been a hectic August morning for Dove. The day before, dead menhaden started appearing on the lower Neuse and ever since, he's been shuttling reporters and camera crews to the site of the fish-kill. Like a tour guide, he shows us a mile-long section of water east of New Bern known locally as the "kill zone." There, fish float belly-up every couple of feet almost across the entire river. Red, puffy sores can be seen on the lower half of their bodies—the telltale signs of *Pfiesteria piscicida*. Some menhaden are still alive, but with a portion missing as if the microorganism had taken a bite out of them. Normally comprised of reeds and driftwood, the tideline along the shore—this day—is a continuous stretch of silver menhaden drying in the sun.

One of the local affiliates wants footage of

NEUSE RIVER BASIN

Dove netting dead fish for its 6 p.m. broadcast. At the same time, a Raleigh station has sent a satellite truck to "go live" for an on-air interview with him at 5:30. It's a stressful situation. But Dove, Riverkeeper for the Neuse River Foundation since 1993, handles himself with the confidence of someone who has done this a hundred times. That could be a conservative estimate.

When it comes to the Neuse, any environmental concern attracts a white-hot spotlight from news organizations. Floods, dead fish, sediment plumes, algae blooms, the discovery of a flesh-eating microorganism—all of these have dominated headlines and led broadcasts during the 1990s.

So noticeably has water quality declined on the river, that American Rivers—a national environmental watchdog group—has classified the Neuse as one of the 20 most threatened waterways in North America.

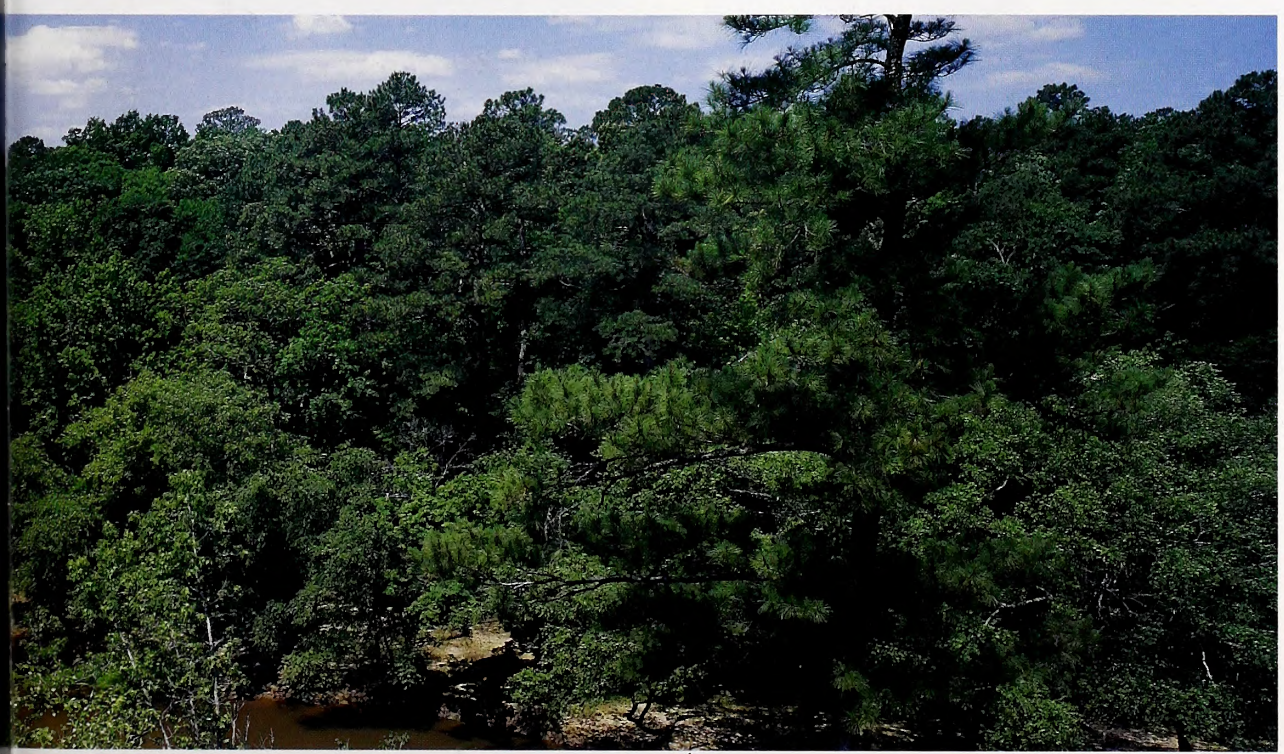
"From 1990 all the way through 1999, we have been able to see a definite pattern of degradation," says Dove, who has lived on the river since 1975. "Beginning in 1990, degradation in the river became so acute, we began seeing changes year after year."

No more important geographically than any other river, the Neuse happens to be located, politically, at ground zero for the battle over water quality in North Carolina. Because the river and state legislation both begin near Raleigh, environmentalists are clinging to the Neuse as the final fallback position.

"With all that has been said and done about the Neuse River, the bottom line is that if we can't fix it, then we've lost all of the rivers in North Carolina," Dove says.

The galvanizing nature of the Neuse is also due to a number of controversial issues that span a wide cross section of central and eastern North Carolinians. Though estimated to be 2 million years old, the river and its basin have become quite modernized with one of the fastest growing populations in the country. In 1970, the Triangle portion of the Neuse watershed (where most contamination originates) was home to about 370,000 people.

***Rick Dove,** Neuse riverkeeper since 1993, navigates his boat past New Bern's waterfront while looking for signs of water contamination. This panoramic view of the river (below) was taken from Cliffs of the Neuse State Park.*



NEUSE RIVER BASIN
FACTS

Size of watershed: 6,235 square miles

Total streams and rivers: 3,443 miles

Major tributaries: Eno, Flat, Little and Trent rivers; Crabtree, Swift and Contentnea creeks

Municipalities: 73

Population: 1,195,763 (1996)

Major land use: Forest

Atlantic drainage

States flow through: N.C.

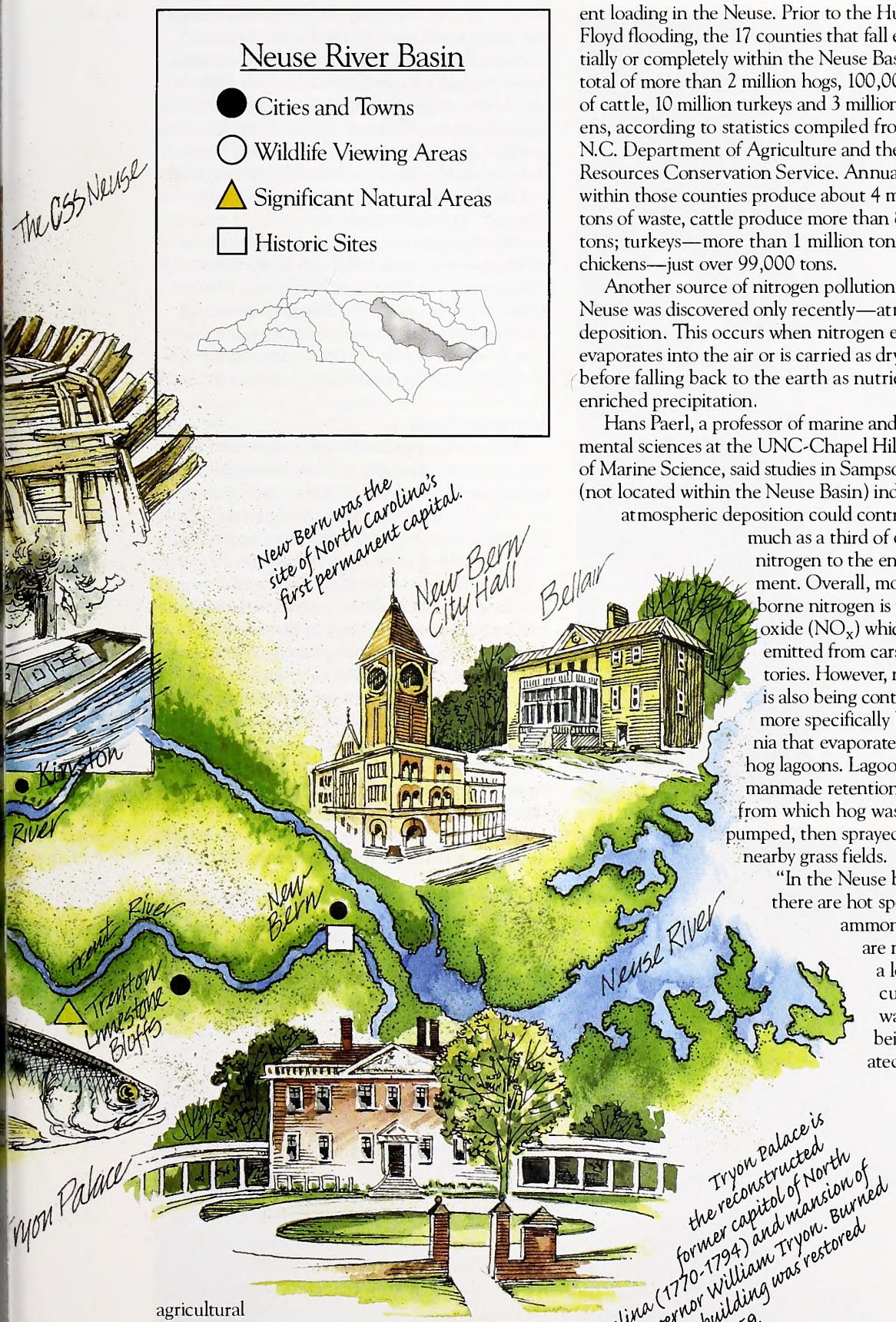
ILLUSTRATED BY CHRIS ARMSTRONG ©1999

That population is now closer to 600,000 and projected to be almost 1 million by 2010. Construction around communities adjacent to the river causes the most degradation by allowing sediment to wash into the river. The sand and dirt particles aren't so much a problem as the chemicals they carry with them. Contaminants such as lawn fertilizers and heavy metals from automobiles attach to sediment and eventually wash into the river.

Also, thousands of tons of human and animal waste byproducts filter into the Neuse as nitrates and phosphates every year. These substances are nutrients, which in small amounts can be healthy for a river. However, massive quantities cause the growth of algae, bacteria and other aquatic organisms that can rob a river of oxygen and lead to fish-kills.

Nutrients flowing from individual outlets, called point-source discharges, come from partially treated sewage consisting of human waste, food residues and some cleaning agents. After being treated, effluent from towns along the river is often pumped directly into the Neuse. There are currently more than 400 active point-source waste discharge permits responsible for 100 million gallons of partially treated wastewater poured into the Neuse each day. According to the Department of Environment and Natural Resources' Water Quality Section, municipal point-source waste pollution contributes 13 percent of the nitrogen and 23 percent of the phosphorus.

Yet an even larger amount of nutrient pollution comes from non-point sources such as



Tryon Palace is the reconstructed former capitol of North Carolina (1770-1794) and mansion of royal governor William Tryon. Burned in 1798, the building was restored during 1952-1959.

agricultural practices and forestry. Fertilizers and livestock waste contribute 60 percent of nitrates and phosphates, while forested land contributes 13 percent of the nitrogen and 6 percent of the phosphorous.

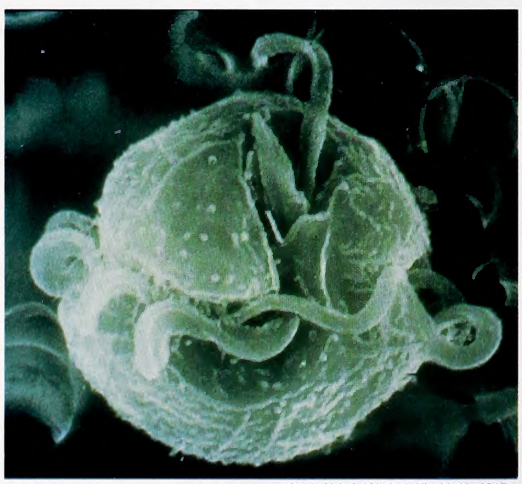
Intensive livestock farms (mainly swine facilities) have shouldered much of the blame for nutrient loading in the Neuse. Prior to the Hurricane Floyd flooding, the 17 counties that fall either partially or completely within the Neuse Basin had a total of more than 2 million hogs, 100,000 head of cattle, 10 million turkeys and 3 million chickens, according to statistics compiled from the N.C. Department of Agriculture and the Natural Resources Conservation Service. Annually, hogs within those counties produce about 4 million tons of waste, cattle produce more than 800,000 tons; turkeys—more than 1 million tons; and chickens—just over 99,000 tons.

Another source of nitrogen pollution in the Neuse was discovered only recently—atmospheric deposition. This occurs when nitrogen either evaporates into the air or is carried as dry dust, before falling back to the earth as nutrient-enriched precipitation.

Hans Paerl, a professor of marine and environmental sciences at the UNC-Chapel Hill Institute of Marine Science, said studies in Sampson County (not located within the Neuse Basin) indicate that atmospheric deposition could contribute as much as a third of overall nitrogen to the environment. Overall, most airborne nitrogen is nitrogen oxide (NO_x) which is emitted from cars or factories. However, nitrogen is also being contributed more specifically by ammonia that evaporates from hog lagoons. Lagoons are manmade retention ponds from which hog waste is pumped, then sprayed onto nearby grass fields.

"In the Neuse basin, there are hot spots of ammonium that are near where a lot of agricultural waste is being generated," Paerl

KAREN TAM



JOANN BURKHOLDER / HOWARD GLASGOW

RICK DOVE

N.C. State *University professor JoAnn Burkholder inspects a vial containing water from a fish kill where* Pfiesteria *was suspected.* Pfiesteria *(shown right, through a microscope) has been linked to numerous fish kills along the coast. The menhaden (below) were attacked by the aquatic organism on the lower portions of their bodies.*

added. "But the dominant source of atmospheric deposition is still internal-combustion engines."

Regardless of the source, all of these contaminants gradually enter the Neuse, which drains into the poorly flushed Pamlico Sound. A study last year conducted by researchers at the University of North Carolina at Wilmington found that one-third of the mud beneath the Albemarle and Pamlico Sounds was contaminated with chemicals and toxic metals.

"We were very surprised at the extensive distribution of toxic materials," says UNC Wilmington biology professor Courtney Hackney. "We were expecting there would be some hotspots near industrial sites. But we were very surprised about how far and how wide the contamination was and the impact in some areas where nothing was alive."

A Killer Surfaces

While toxic chemicals are detrimental to certain aquatic species, nutrient pollutants have proven highly beneficial to bacteria and to one microorganism in particular—*Pfiesteria.* Part-plant, part-animal, *Pfiesteria* is a spectacularly lethal microscopic organism responsible for killing millions of fish.

JoAnn Burkholder, a N.C. State University professor who has studied the microorganism since 1989, said it was first found in the university's veterinary school aquarium, which had been filled with water from the Pamlico Sound. In 1991, Burkholder positively connected the dinoflagellate in the lab to a fish kill on the coast.

"It killed fish so fast in the aquarium, we thought it might be linked to some of the massive fish kills we had been hearing about in the late 1980s and early 1990s," she said. "We knew how to look for it based on the laboratory accident. So, we caught it swimming in the water during a fish kill, brought it back to the laboratory, and it looked like the original veterinary school contaminant. We began to work with it, and everything unfolded from there."

"It has killed every organism we have given it, every finfish, every shellfish—every species."

—JoAnn Burkholder

Burkholder and a team of researchers have since determined that *Pfiesteria* is a newly documented family, genus and species of dinoflagellates that she believes could be 450 million years old. Until a few years ago, no dinoflagellates were believed to produce toxins. However, *Pfiesteria* has been proven to have that capability as well as a few more surprises. So far, researchers have identified 24 life stages of the microorganism as well as five more yet to be classified. By changing forms, *Pfiesteria* can prey on everything from bacteria to mammalian tissues. Simply put, it is a survivor.

"It has killed every organism we have given it, every finfish, every shellfish—every

species," Burkholder said.

It has even attacked humans, causing sores and mental disorders. About six years ago, Burkholder and fellow researchers were exposed to its toxins and suffered severe cognitive disorders. "We could recognize words, but we could not form sentences," she said. "We could add 1 plus 1, but not 3 plus 4. My research associate had to take reading lessons to recover. At one point, he could not remember his name or how to find his way home." Luckily, most of the severe neurological complications were short-lived; however, Burkholder says she and some staff members have yet to fully recover.

Pfiesteria is believed to pose a health risk only when in its toxic stage. It typically reaches this stage in mid- to late summer when water temperatures are warm. Upon detecting prey, the organism transforms within minutes into a toxic amoeba form, which stuns the fish, then literally strips its skin. However, because *Pfiesteria* is most vulnerable during this period, the organism changes again into a more protected form while feasting on the fish carcasses along the river bottom.

If fish are not available as a food source, *Pfiesteria* simply changes into a nontoxic vegetarian. "When they eat algae, they will digest everything except the chloroplast—the part that does the photosynthesis," Burkholder added. "Because chloroplast contains plant pigment, they can masquerade as a plant, letting the chloroplast maintain function. When they do that, they can directly consume organic nutrients (phosphates and nitrates) just like a plant would."

And that, Burkholder believes, is *Pfiesteria's* Achilles' heel. She advocates combating the organism by reducing the plant food (nitrates and phosphates) the organism needs to grow. By doing this, scientists think *Pfiesteria*, for the most part, can be maintained in a smaller, less harmful form.

"We can deal with this organism just like any other pathogen," Burkholder said. "We can treat it with respect, develop early warning systems and stay out of the way when there happens to be a problem."

Reacting to public concern, the state Division of Water Quality has made significant strides toward developing such early detection systems. At present, the agency has a Neuse River Rapid Response Team based in Washington, N.C., and another based in New Bern. Once a kill is reported, the teams are immediately dispatched to the area where they gauge the number and species of fish affected, the range of the incident and the various water-quality values such as low oxygen and algae blooms. If water samples are found to contain evidence of toxins, the public can be warned quickly.

A Call to Arms

More than any other issue, *Pfiesteria* has ignited the movement to restore the Neuse River. The lethal organism has come to symbolize all that is bad with our polluted waterways. No longer is water contamination just a health risk in some faraway Third World country. The problem is here, now, in eastern North Carolinas' backyard. And a growing number of citizens are uniting, determined to reverse the situation.

One such group is the Neuse River Foundation, a nonprofit organization that is monitoring the river, informing the public and working with government leaders. Formed in 1980, the New Bern-based foundation has grown steadily, obtaining an office, about 2,500 members, three fulltime staff members and, of course, Rick Dove.

Since 1993, Dove has been the most visible foundation member. As Neuse Riverkeeper, he is

MELISSA McGAW

***Intensive livestock** operations, like these hog houses near Kinston, have shouldered much of the blame for nutrient loading in the Neuse River. During the floods from Hurricane Floyd, more than 50 livestock facilities were completely flooded in eastern North Carolina and 300 others reported problems, according to the N.C. Division of Water Quality.*

Members of the *Neuse River Foundation gather at the Cliffs of the Neuse State Park. From left are: Marion Smith, Mary Ann Harrison, Elizabeth Heim, Jane Ashford, Heather Beard and Kenneth Dauphin. Back row from left are: Tony Daw, Fritz Herman, Jim Horton, Charlie Ashford, Jerry Heintzelman, Tom Sinclair, Jim McLean, Darwin Crumpler, Rick Dove and Jason Guins. Two members of the Neuse River Rapid Response Team (right) take water samples on the river.*

point-man for the organization, watching over the waterway and often serving as spokesman. "My job is to go out on the river, figure out what is happening, talk to the people, talk to the scientists and find out what can be done," Dove said.

In addition to Dove's daily patrols, the organization has an "airforce" comprised of five private pilots who perform aerial surveys from Raleigh to the coast. Also, 200 volunteers monitor the river by boat or car.

To educate and inform adults, the Neuse foundation publishes a quarterly called *Know the Neuse*, as well as three annual newsletters. The foundation also has the "Little Riverkeeper" program that involves New Bern 5th graders flying with river pilots, conducting tests, keeping water-quality records and phoning in reports.

A Five-Pronged Attack

All combined, this citizen activism has resulted in a series of major government efforts, the most significant of which is the Neuse River Nutrient Sensitive Water Management Strategy Rules. Approved by the N.C. General Assembly in 1998, the management strategy seeks to reduce overall nitrogen loading in the river by 30 percent. Bill Holman, Secretary of the state's Department of Environment and Natural Resources, believes that goal can be reached through a sustained effort.

"The Neuse River didn't get sick overnight," Holman said. "It will take years of dedicated commitment to restore it to health. However, the support from the public, the scientific community, Governor Hunt and legislators has reached an unprecedented level. That sustained support is essential to cleaning up the Neuse and other rivers."

The state Environmental Management Commission hopes to achieve the 30 percent reduction by addressing five areas of degradation: existing riparian buffers, wastewater discharges, urban and agriculture stormwater run-

off and nutrient management.

• **Buffers:** The riparian rule requires that 50-foot buffers of vegetation be maintained adjacent to the river. The vegetation's root systems hold soil together and also serve as filters, removing nutrients before they run off into streams or ditches.

• **Discharges:** Industries and municipalities with significant wastewater discharges into the river are being required to jointly reduce those contributions by 30 percent. Cities such as Goldsboro and Kinston have united with industries such as Carolina Power & Light Co. and Dupont to form the Lower Neuse Basin Association. Together, they are working on ways to operate their plants more efficiently to reduce emissions.

• **Urban runoff:** The urban stormwater rules require 10 of the major cities in the Neuse Basin and five counties to develop stormwater management plans that would limit new developments to a maximum of 3.6 pounds of nitrogen per acre, per year. The cities are: Cary, Durham, Garner, Goldsboro, Havelock, Kinston, New Bern, Raleigh, Smithfield and Wilson. The counties are: Durham, Johnston, Orange, Wake and Wayne.

• **Agricultural runoff:** Farmers will be required to either participate in a local nitrogen reduction strategy by 2003 or implement standard best management practices by 2002.

• **Nutrient management:** People who fertilize 50 or more acres (e.g., golf courses) must complete a certified nutrient management training course by 2003. Or, the person must implement a nutrient management plan approved by the Natural Resources Conservation Service.

To assist this five-point plan, N.C. State University has developed the Neuse River Education Team. Through this effort, N.C. Cooperative Extension Service agents work directly with landowners to show how various land practices can be modified to benefit the river. "Our focus is to implement best management practices that control nitrogen in urban and agricultural areas. And we do that through a focused educational effort," said Mitch Woodward, coordinator of the education team.

Government reaction during the past five years is proof of the widespread concern surrounding the condition of the Neuse. No longer are the problems affecting a small group of individuals in rural North Carolina. Instead, water degradation has spanned much of the river's length, affecting growing towns such as Goldsboro, Kinston and Seven Springs. And like the pollution, the whole issue culminates at New Bern, a city expanding with retirees who, along with other residents, have the time and financial means to devote to this cause. Indeed, the level of commitment radiating from this movement is something quite different from ordinary feel-good environmental campaigns. The matter for many folks is one of "must" rather than "should." And it's easy to see why. What's at stake is not just the Neuse. It's all of North Carolina's rivers and ultimately, ourselves.

The Neuse: Up Close and Personal

■ When I was assigned to write the story on the Neuse River for this special magazine issue, I knew I would be covering a well-trodden subject. North Carolina newspapers have drained barrels of ink documenting the decline of this river. Even so, I had my orders and was determined to immerse myself in the murky world of nitrates, sediment loading and runoff. But I also knew this project would entail something I was even more interested in. After all, who can really talk about a river if

N.C. ARCHIVES AND HISTORY

***The social** importance of the Neuse River hasn't been limited to transportation and fishing. It has also played an important role in religion. A baptism (below) is conducted near New Bern during the early 1900s.*

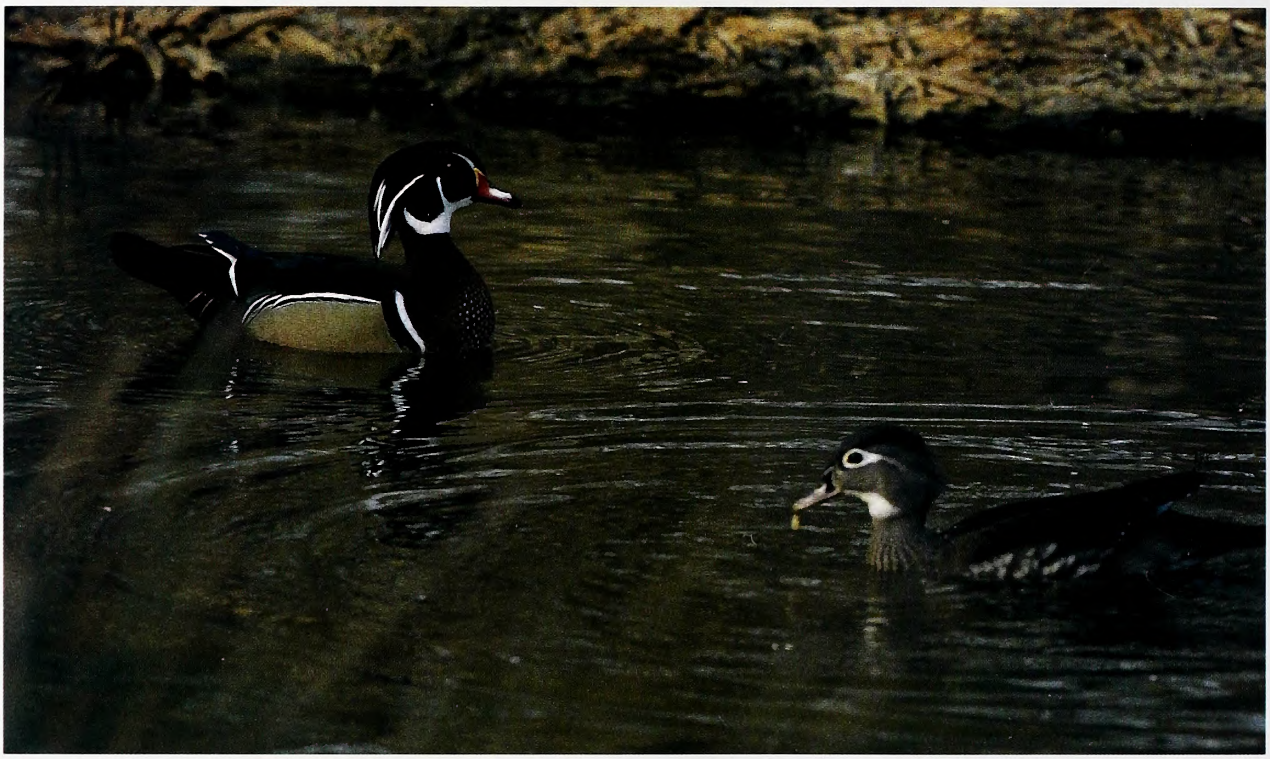
they haven't been on it? And how many people get a chance to be Huck Finn or Tom Sawyer for a few days? So when spring finally broke, fellow co-worker Lee Ratcliffe and I started making plans to see for ourselves what all the fuss was about.

In recent years, many writers in the area have taken solo canoe trips down the Neuse to achieve a type of spiritual connection with the river. My excursion would be nothing like that. I opted to take along a companion for a number of reasons. For starters, our transportation was a powerboat, and Lee would come in handy if gas tanks had to be toted to not-so-nearby filling stations. Also, at about 6-foot-five, he looked to be an able paddler if I misjudged our fuel consumption. Finally, we were headed for bear country, and under the right circumstances, I believed I could outrun Lee. No, this writer was not going alone.

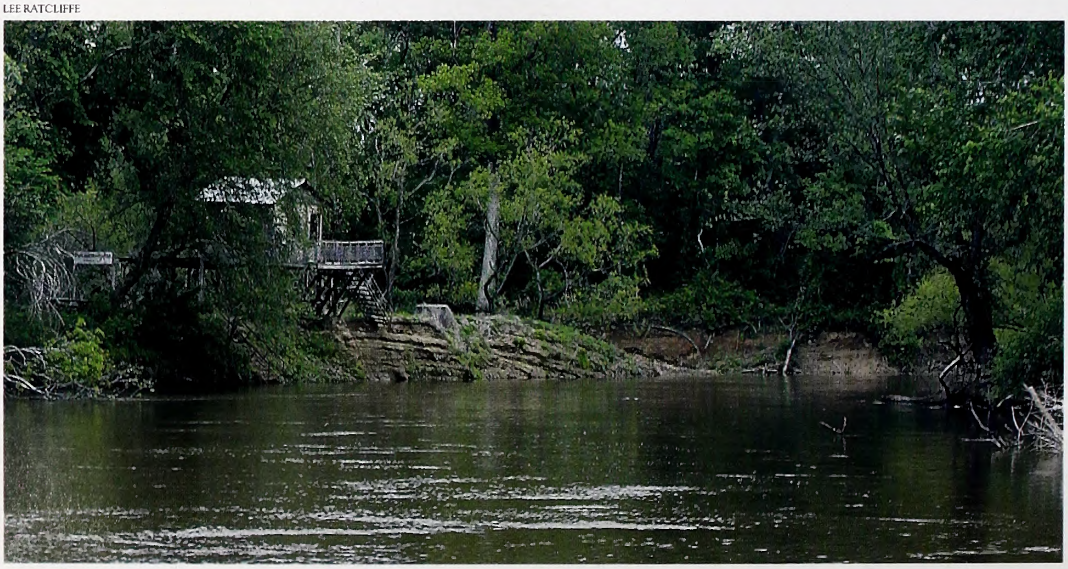
We readied for the trip by seemingly emptying a small grocery store, then cramming the little boat with every piece of camping equipment we could find. Preparing for wet weather, Lee stuffed most of his gear into trash bags, giving our craft the look of a New York garbage barge. Fully loaded, the boat had barely room enough to sit in.

The plan was to launch at Smithfield and be in New Bern in three days. I had wanted to start at the beginning near Falls Lake Dam, but that stretch is shallow and rocky, and the fisheries biologist who had loaned me his boat was expecting it back—intact. There was also another problem: the Milburnie Dam, near Raleigh, required a portage too lengthy for our heavy 16-foot johnboat and 30-hp motor. Jumping the obstruction, we decided, was not an option.

Once on the river, we faced our first test right



LEE RATCLIFFE



***Whether it's** floa hunting for wood ducks or fishing from an isolated camp (bottom), the Neuse River continues to be an excellent place to spend a day outdoors.*

RODNEY FOUSHEE

After three days camping on the Neuse, Lee Ratcliffe (left), a graphic designer for the magazine, and Chris Powell, the author, wearily pose for a picture while taking the boat out at New Bern.

out of the gate. Coming around the bend, we saw what appeared to be a logjam. Trees, limbs and trash had collected in the river's elbow and almost stretched across the entire width. Because of the river's pace, there was no way to ease up and investigate the situation. We could only choose a small opening, motor into position and hope for the best. Approaching the obstruction, I had a clear mental image of the boat catching on the debris, going sideways and rolling us into the frigid water. But as fortune would have it, we shot straight through, and gained the confidence we would need to tackle one of these after another.

It felt good standing in the back of the boat with the wind in my face, steering that sputtering engine. We saw an amazing amount of wildlife, for a river said to be on its deathbed. Wood ducks, kingfishers and blue herons were common. We also saw a deer, a turkey and a few muskrats.

"...I had a clear mental image of the boat catching on the debris, going sideways and rolling us into the frigid water."

Nearing Goldsboro, we came to a fork where we could go left or straight, and I chose steady-as-she-goes, not realizing what lay ahead. We spied a promising camp location and stopped to investigate. It's a good thing we did. Upon pulling the boat up, Lee noticed a peculiarity in the river about 20 yards downstream. The river appeared to angle downward in a strange manner, so we walked the bank to check it out. What we discovered was the gentle angle actually was an old submerged dam with a raging whitewater drop-off on the other side. Had we hit the structure at full steam, I suspect you'd now be reading a tribute to the memory of two Wildlife Commission employees.

As we steadily moved eastward, the temperature dropped and most of the wildlife we viewed was waterfowl. All along the way, we saw a number of rustic fish camps that ranged from relatively new to practically primitive. The sight of those shacks and a few silent anglers reminded me that people have fished and hunted along this river as far back as the pre-Colonial days and before that. Arthur Barlowe, an early settler, named the river in 1584 after the resident Neusiok Indians. The name of the tribe means "peace," which is an ironic designation for a river known for tribal warpaths and Civil War skirmishes.

Settlement along the river started in 1710, when the German and Swiss Palatines, under the leadership of Baron Christoph von Graffenried and John Lawson, established the town of New Bern. That outpost led to the gradual western development of the Neuse watershed that we know today.

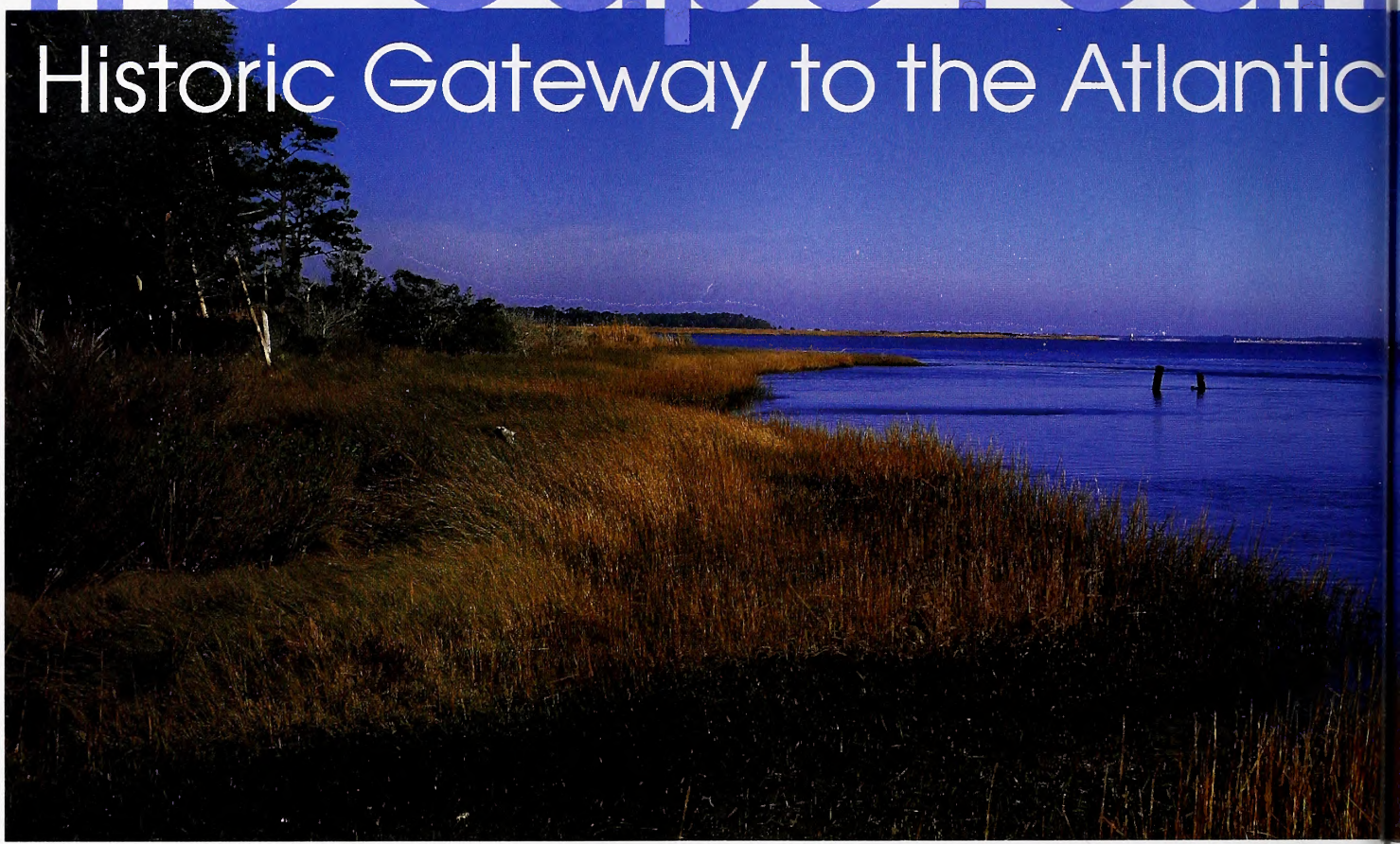
On Monday, the last day of the trip, we awoke to a gorgeous morning that warmed to the low 80s. For the first time, we could stow our coats and blast down the river donning T-shirts and sunglasses. This was our favorite part of the river and the best leg of the trip. The lower portion of the Neuse is dominated by cypress swamps and appeared to be more like a blackwater river.

Before reaching New Bern, we decided to take a fish sample, just for scientific reasons. Slowing the boat to a crawl, we started working lures along the shore. Lee used a crankbait to hook a chain pickerel that we determined was in fine health—based on the fight it put up. We also encountered a beaver that swam parallel to us for a good 10 seconds, either unaware or unconcerned about our presence.

The overall impression both Lee and I took from the Neuse is that the river is not a wasteland. The river does have problems, bad ones. But despite its well-documented contamination, the Neuse is still remote in parts and home to a tremendous amount of wildlife. It's a place where monster catfish can be caught, ducks and deer hunted, birds watched and tents pitched. For Lee and myself, the river allowed two young men to be kids again, and live out a modern-day Mark Twain tale. ⊠

The Cape Fear:

Historic Gateway to the Atlantic



History lies easy on the Cape Fear River, the state's largest river basin. Though the pirates are gone, and so are the region's once vast stores of rice, turpentine and timber that floated the river highway to worldwide markets, the river still carries visible traces of its prosperous past. Yet like other rivers, the Cape Fear today is marred by pollution, and the legacies of the past are taking a back seat to the urgent needs of the present.

written by Philip Gerard©1999

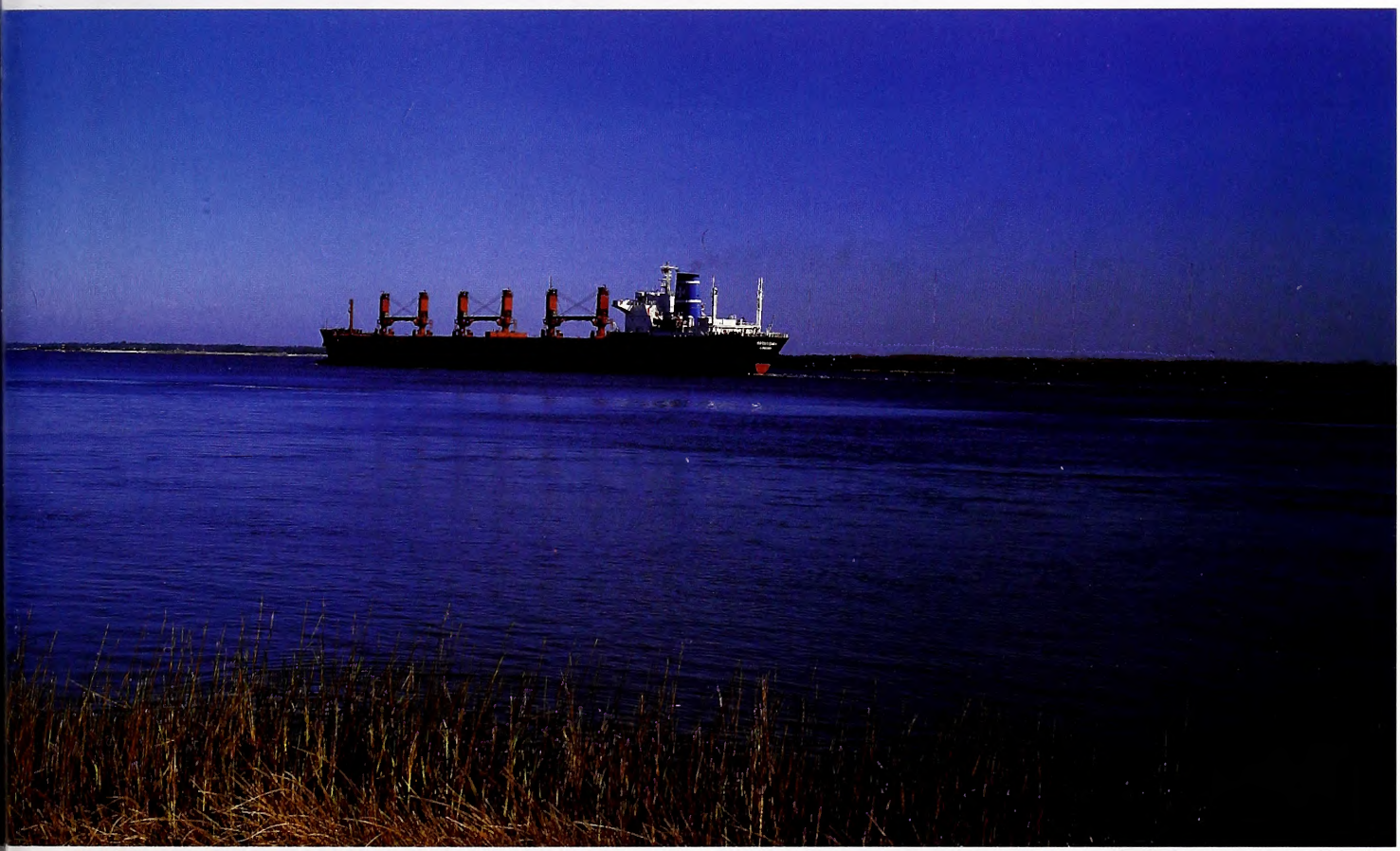
photographed by Ken Taylor

■ "All we know about the river is what we've learned in the last four years. That's our baseline," Cape Fear Riverkeeper Bouty Baldridge explains. "Before that, it's anyone's guess." Baldridge is an easygoing, handsome man, still youthful despite his graying hair. He works out of a small frame house on the southern tip of the Wilmington waterfront, under the auspices of the Cape Fear River Watch.

It's a chilly day in early spring. The sky is bottle-blue, the water flecked with whitecaps. In Baldridge's open boat, we scoot upriver around the horseshoe bends of brown water.

Cormorants work the sandbars for fish. The towboat *Captain Jimmy* slides by pushing a gray chemical barge. Farther on, two fishermen in a johnboat set a drift net. The shoreline is a lush, impenetrable tangle of cypress, water oak, red maple, longleaf pine, sweet gum and shrub thicket, already greening. Turkey vultures perch on a snag, scavenging a dead carp. A great horned owl sweeps across the sky from bank to bank and disappears into the treeline.

Baldridge smiles. "One of the beauties we have here is so much of this river is still natural."



***Like the** sailing ships of old, an oil tanker slips up the Cape Fear near Brunswick Town, making its way to Wilmington, 15 miles upstream. Despite the notorious shoals at its mouth, the Cape Fear is the only North Carolina river with direct access to the Atlantic.*

We catch up to the chemical barge, spinning 180 degrees to moor against dolphins—bundled mooring pilings—near a riverbank that looks wild and overgrown. We spot an osprey diving and Baldridge points out an active nest in a broken, bleached-out cypress tree. "Back in '87, we'd be hard-pressed to find an osprey nest," Baldridge says. "Now I can take you to five or six active nests."

At the confluence of the Cape Fear and the Black River, we throttle down and drift. The water darkens in a distinct line as it enters the Cape Fear channel. The Black is a "blackwater" river, stained with tannin from rotting vegetation, mainly cypress. The water is clear—not clouded with silt—and it's clean, but dark.

Above the Black, the Cape Fear is actually a "clearwater" river, owing to its origins in the clearwater streams of the Piedmont. Nowadays, the Cape Fear runs brown, turbid from sediments washed into it far upstream.

Sedimentation and pollution from runoff are the most pressing problems on the river, and in some ways the most frustrating, because they are the hardest to control. Baldridge says, "You'd be surprised at how many people, not kids but adults, don't know that the water off our streets empties directly into the river. A simple concept like that. They think it's treated first."

The Cape Fear is so picturesque it takes imagination to realize that under the surface it is being stressed.

Three Rivers

The Cape Fear is really three rivers: a clearwater Piedmont stream that rises at the confluence of the Deep and the Haw; a meandering coastal "brownwater" river draining farmlands and carrying thousands of tons of silt; and a 30-mile long coastal estuary that functions as both a primary fish nursery area and a ship channel.

It's a river of many superlatives. Sprawling over 9,000 square miles, it's the largest river basin in the state, so big that it reaches into nearly a third of the state's 100 counties. It stretches 200 miles, from Mermaid Point at the confluence of the Deep and the Haw, to Cape Fear on Bald Head (formerly Smith) Island. The basin contains 107 cities and towns and a quarter of the population of the state.

The Cape Fear is also the most heavily industrialized river in North Carolina—General

Electric, DuPont, International Paper Co. and a host of other large industries are sited along the river. Yet stretches of the river are also among the wildest of any waterway in the state, mainly because the swampy nature of the basin has thus far made it inaccessible and financially unrewarding for development.

It reaches from the Piedmont to the Atlantic Ocean like a great artery, fed by 6,189 miles of tributaries—including 397 named streams. It's the only North Carolina river with a deepwater shipping channel—38 feet deep from the bar to the Northeast Cape Fear, and 8 feet deep from Wilmington to Fayetteville. Unlike other industrialized rivers that flow into sounds, the Cape Fear is the only river in North Carolina that connects directly to the sea.

This fact alone has given it a long and rich history unlike almost all other Tar Heel rivers.

The Cape of Fear

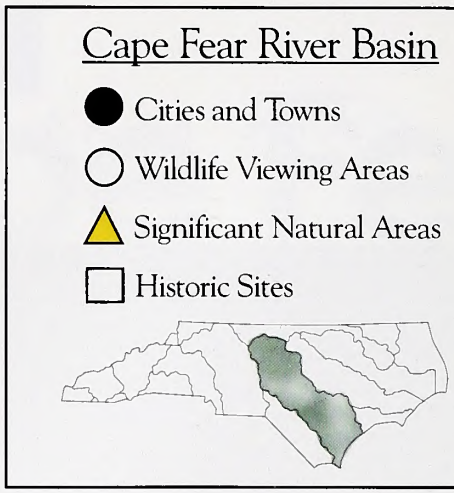
The Spanish called it the "Rio Jordan" when they explored the Cape Fear in 1526. English explorers later called it the "Cape of Feare" and the "Charles," after the king who gave his name to the Carolinas. The natives knew it as the "Waccamaw."

In the early days, the notorious Frying Pan Shoals, which fan out nearly 20 miles to sea, created a shifting, treacherous gauntlet for any mariner trying to enter the Cape Fear estuary. Giovanni de Verrazano explored the Lower Cape Fear in 1524 on behalf of his patron, Francis I of France. He stayed only slightly longer than his successor, Lucas Vasquez de Ayllon, who arrived two years later and promptly foundered his ship on Frying Pan Shoals.

The New England Puritans engaged Capt.

LAWRENCE S. EARLEY

On the banks of the Black River, a major tributary of the Cape Fear, headstones in the graveyard of the Ivanhoe Presbyterian Church remind the onlooker of the Scottish origins of many of the region's early settlers.



William Hilton to explore the Cape Fear region. In 1663, he landed on the site of what is now the Cape Fear Marina. In Hilton's report, the first such written report of the Cape Fear River, he speaks with fondness of "Cape-Fair," a region full of deer, bear, otter and every kind of bird, including eagles (probably ospreys), wild turkeys, ducks, geese, passenger pigeons and millions of Carolina parakeets.

Soon afterward, a contingent of colonists from Barbados established Charles Town, an Indian trading post, on the west bank of the estuary. Lashed by storms and politics, the settlement lasted only four years, dissolving in 1667.

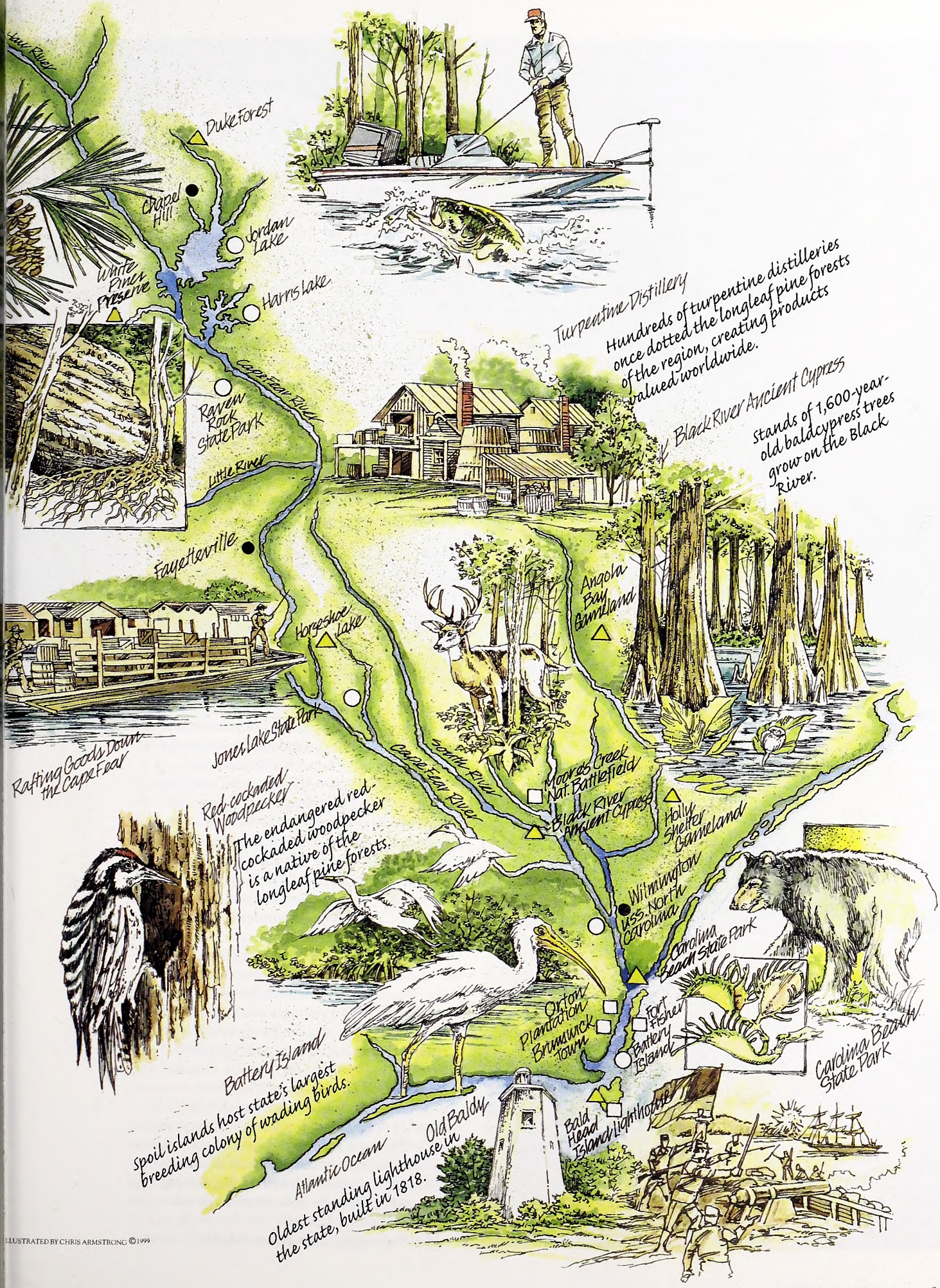
It would take another three generations before whites settled on the Cape Fear in any numbers. The problem was not just Frying Pan Shoals but pirates. A nest of them, including Edward Teach, better known as Blackbeard, and Stede Bonnet, threaded the shoals and hid in the lower estuary where they could sally forth and plunder shipping both from Charleston to the south and from the Virginia capes to the north.

From Charleston came a punitive expedition led by Col. William Rhett bent on clearing the estuary of pirates. Caught off guard in the Cape Fear estuary by Rhett's fleet, Bonnet was captured after five hours of pitched battle, then hauled to Charleston where he was hanged along with 29 of his crew on Dec. 10, 1718. Shortly thereafter, Blackbeard was killed at Ocracoke Island.

The coast—in a literal way—was clear.

The pioneers of the Lower Cape Fear promptly decimated the local Indian population, chasing the survivors off the Cape Fear and claiming it. They established Brunswick Town 12 miles inland and carved out their great plantations on the western bank, the high ground with a long inland reach. Roger Moore built his plantation, Orton, just north of Brunswick Town, where it stands today nearly unchanged. It became the headquarters of a 12,780-acre domain.

This region, with its capital of Brunswick Town, soon became the naval stores capital of the British Empire. Vast forests of longleaf pine trees flanked the river for 100 miles upstream. In the 18th and 19th centuries, these trees were



ILLUSTRATED BY CHRIS ARMSTRONG ©1999

boxed for their sticky gum, the raw material for spirits of turpentine and rosin. Smoky tar kilns produced the tar that kept England's sea-sweeping navy afloat. Eventually the forests were cleared for lumber, crops were planted and settlement quickly spread upriver.

The planters dug rice canals, slashed roads through the longleaf forests, drained and filled swampland. Hardly arrived, they were already changing the river.

The Lower Cape Fear was populated by the largest concentration of slaves in the state. They worked the large rice plantations and turpentine orchards. Rice culture in particular was brutal and dangerous work—mosquitoes, disease, alligators, snakes and the sweltering humid heat made it so hard on laborers that after the Civil War, men could not be found to do the work for wages.

Brunswick Town on the lower estuary, like Charles Town before it, was vulnerable both to hurricane winds and raids by the Spanish, with whom England seemed to be constantly at war. Before long, the new settlement of Newton, later called Wilmington, supplanted Brunswick Town as the region's capital. It was located in a naturally advantageous position on the east bank at "The Forks" of the Cape Fear and Northeast Cape Fear. From hinterland farms, cypress-log periaugers floated down the Northeast Cape Fear, the Black and the main channel loaded with vegetables, deerskins, tobacco and timber. Shallow-draft coasting schooners tacked upriver on the tide and vied for space along Wilmington's waterfront.

During the Civil War, the Cape Fear became a lifeline to Gen. Robert E. Lee's army. Blockade runners, called "gray ghosts," ran in under the guns of Fort Fisher and steamed upriver to Wilmington, the last open port of the Confederacy.

By 1898, with a deepened river channel, Wilmington was the largest, wealthiest, most politically prominent city in North Carolina, and the largest exporter of cotton in the world. Yet by 1915, progress had largely passed it by.

***In the mid-19th** century, the Cape Fear region was the greatest producer of turpentine and rosin in the world. This photo, taken a century ago, shows barrels of naval stores being gathered on the docks at Eagle Island, with Wilmington in the background.*

N.C. ARCHIVES AND HISTORY

The State Port of Wilmington

From the sea buoy south of Bald Head Island, the channel runs northeast, through the Frying Pan Shoals close by Bald Head—home of the actual Cape Fear—where Old Baldy, a nearly 200-year-old lighthouse still stands.

The channel is 500 feet wide across the ocean bar, narrowing to 400 feet farther upriver—just wide enough for two ships to pass each other, very carefully. The turning basin by the port is 1,200 feet wide.

Already, the biggest ships are scraping their bottoms on the riverbed, and waiting a few hours for the tide to rise can be expensive—it costs $60,000-$70,000 per day to operate a container ship. The Corps of Engineers has begun preliminary work to deepen the channel from 38 feet to 42 feet by 2006 at a cost of $329 million. The project may take as long as six years.

Last year 411 ships and 111 barges called at the port, loading forest products, iron and steel products, frozen poultry, farm equipment and tobacco; unloading Japanese steel, South American fruit and Asian cotton.

And containers—4,000 of them stacked three-high on 14 acres in the yard. They arrive by truck and are offloaded by "toplifter" cranes; or they arrive on ship and are offloaded by one of the five 100-foot-tall container cranes. A driver can arrive at the port, drop his container, pick up another, process all his paperwork electronically, and be on his way in 40 minutes.

One breezy warm evening on the river, an hour before true sundown, I head down to the Wilmington port. The air is soft. Luminous, rosy clouds scud across the sky to the east. Just below the Cape Fear Memorial Bridge, at the McAllister Towing dock on the western bank, I clamber across two moored tugs to get to the outboard boat, the 103-foot-long *Barbara McAllister*. Tonight she'll work in tandem with another tug, the *Clearwater*, to dock the *Hanjin Los Angeles*, a 950-foot-long container ship of 51,754 tons. I'll be aboard.

Capt. James K. Galloway steps aboard, pours a cup of coffee in the forward galley, then climbs up to the wheelhouse. He'll work the vessel tonight as usual with just an engineer and a deckhand.

Last aboard are the docking pilot, Jerry Champion, and a young apprentice pilot. Champion has been on the river for 30 years, the last 18 of them docking the big ships.

"The biggest problem is getting the ship stopped and maintaining control," Champion says. "All the rest is a matter of push and pull." He's a quiet, plainspoken man with black hair and a steady manner. "It's kind of like driving on ice and you have to make your car go sideways into a parking space."

Now we see the *Hanjin Los Angeles*

***Capt. James K. Galloway** pilots the 103-foot tug* Barbara McAllister *near downtown Wilmington. Modern-day Wilmington is still the major North Carolina port, although container ships are more likely to ply its waters than rafts and pole boats.*

rounding the last bend before the port—an immense black hull, a deck piled four-high and 13 across with containers.

The *Barbara McAllister* closes the distance, swings across the current and slides up next to the ship, edging in closer, dropping back along the great hull until we're even with the boarding ladder, pacing the larger vessel. Now comes the most dangerous part of the pilot's day: He must climb up a rope ladder 10 feet or so to reach the bottom of the boarding stairs.

Champion steps onto the rail of the tugboat. He swings himself onto the ladder and climbs up the moving black hull until he can reach the landing of the boarding stairs, then swings over and ascends the stairs.

I'm next. I watch the moving hull, close enough to touch. Watch the gap of gray river between the ship and the tug. Step onto the rail and clutch the rope ladder, step across the open space. I can feel the warmth of the black steel as I climb.

On the bridge of the container ship, the pilot assumes command of the ship. The bridge is wide enough for a major league pitcher to warm up in, manned by four khaki-uniformed officers, a helmsman in bright orange *Hanjin* coveralls who steers the ship using a steel wheel the size of a dinner plate, and the captain. From the bank of slanted windows, we can see the giant spread of the deck, piled high with containers, looking too fat now to ever make it up the channel.

Off the starboard bow, the towering orange container cranes of the port are coming up fast, their tops almost at eye-level.

In a voice without inflection, Champion gives an order to the captain, who repeats the order to his crew. He slows the ship, stops, then reverses engines, uses bow thrusters, turns the rudder, orchestrates by radio the *Barbara McAllister* and the *Clearwater*, which push against the port side bow and stern.

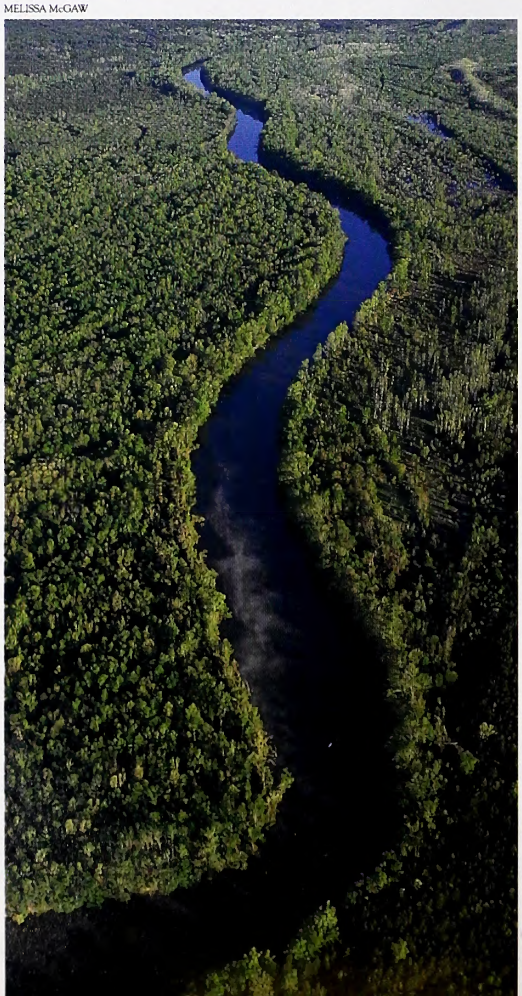
The great ship heels slightly to starboard, slides inexorably sideways in a roil of bottom mud stirred up by the ship's reversed engines.

The *Hanjin Los Angeles* kisses the hold-off bumpers of the wharf. The deckhands in orange coveralls go to work—mooring lines as thick as a man's arm are passed to hands on the wharf. Bow and stern are snugged tight to the wharf.

All at once, the *Clearwater*, pushing at the stern, shuts down with engine trouble. The stern of the *Hanjin Los Angeles*, caught by the river's current, slides away from the wharf. The mooring lines stretch taut, ready to part. The deckhands and dock hands back off—if a line parts, it can whipsaw and cut a person in half.

Champion calmly orders the *Barbara McAllister* around to the stern. From the port wingdeck, we

MELISSA McGAW



The Elwell Ferry *(above) is one of the last car ferries to work the rivers of eastern North Carolina. Before major bridges were built, ferries like these were the only way for people to cross the many creeks and swamps of the region. Though the most populous river basin in the state, the Cape Fear is also one of the wildest rivers (right).*

can see the green and red decks of the tugboats—the *Clearwater* slack, the *Barbara McAllister* nosing in hard against the ship's hull, pushing her back into the wharf. In five minutes, the *Hanjin Los Angeles* is safely docked.

Navigation of the Upper River

Almost from the moment of its discovery, those who settled on the Cape Fear sought to improve navigation on the river. By 1792, the Cape Fear Navigation Company tried to open the river as far inland as the confluence of the Deep and Haw rivers, where the Cape Fear is formed. It built a series of wooden locks and dams, canalizing parts of the channel, but when the company tried to dig a canal around Buckhorn Falls, the granite bottom wouldn't yield.

But much of the river was already navigable for shallow-draft vessels. Throughout the 19th century, flat-bottomed steam paddlewheelers plied the stretch of river between Fayetteville and Wilmington. Steamboats such as *Henrietta, Cotton Plant, Scottish Chief, North State* and *Magnolia* called at more than 100 local landings a quarter of a mile apart, including Devil's Elbow, Catfish Creek, Diamond Duck Point, Brown's Landing, Tolar's Landing and Pull-and-Be-Damned.

Between 1915 and 1936, the U.S. Army Corps of Engineers built three locks and dams, ensuring a channel 8 feet deep from Fayetteville to

Wilmington. There was an unintended consequence, however: the destruction of the shad, bass and short-nosed sturgeon fisheries north of the first dam at Kings Bluff, which cut off 160 miles of river to anadromous fish—those that must swim upstream to spawn.

The Corps recently commissioned a fisheries biologist to find out if there was a landlocked population of sturgeon living above the locks. She found no sturgeon. Above Lock and Dam Two, at Brown's Landing about 71 miles upriver from Wilmington, virtually every fish she caught in her nets or traps was an introduced species. The native species have mostly vanished.

That's 129 miles of river with a brand new fauna.

The Headwaters

Upstream, the river narrows to a winding overgrown channel only a few hundred feet wide. Almost exactly midway between Lillington and Buckhorn Dam, a rocky bluff rises on the west bank of the river—Raven Rock, which took its name in 1854 from the ravens roosting there. Now it's the site of a 3,000-acre state park.

We camped at Raven Rock State Park one night while shooting a TV documentary of the river. We hauled out our flotilla of six canoes and a kayak on the muddy landing below the bluff, then hiked a few hundred yards through the trees up to a broad meadow. There we pitched our dome tents, cooked and sat up half the night around a campfire singing with the cicadas. At dawn, silver mist scrubbed out the treeline, hovered just above our tents, then retreated across the field. In an hour, the mist had lifted and the greenery was vivid again and spangled with dew.

We horsed the canoes into the water and paddled on our way.

Above Raven Rock, the water rushes along in a swift current, fed by streams that cut in from tunneled banks. At the fall line farther upstream, just below Buckhorn Dam, it tumbles through rapids. I've upset a canoe there in the rushing spring freshet, then a few months later scraped the stony bottom at the same spot as the river level dropped by 4 feet in the dry season of early summer.

Two hundred miles upriver from Cape Fear, the Deep and Haw rivers join to form the Cape Fear River. It's a wild place—tangled and overgrown, reachable only by canoe or johnboat, with clear water.

Almost a third of the Cape Fear basin lies farther upriver. The Deep River falls from 800 feet to 160 feet above sea level, and 17 dams regulate its flow—an average of 936 million gallons of water per day into the Cape Fear.

The Haw River, including part of the Upper Cape Fear, was once known as the Saxapahaw in honor of the Indian tribe on its banks. Today the Haw River channel is backed up for 5 miles above the 1,330 foot-long B. Everett Jordan Dam, built at the mouth of the New Hope River as a flood control project in the 1970s. It regulates the Haw River's flow into the Cape Fear.

The confluence is known as Mermaid Point. According to legend, this point was the gathering place for mermaids, who would swim up the Cape Fear from the ocean to wash the salt out of their hair, climb ashore on the sandy spit and sun themselves.

At night you could hear them sing.

Now because of Buckhorn Dam, an obsolete hydroelectric project that once generated electricity for Raleigh, Apex and Cary, the sandy point is underwater.

CAPE FEAR RIVER BASIN FACTS

Size of watershed: 9,322 square miles

Total streams and rivers: 6,282 miles

Major tributaries: Haw River, Deep River, Cape Fear River, Black River, Northeast Cape Fear River

Municipalities: 107

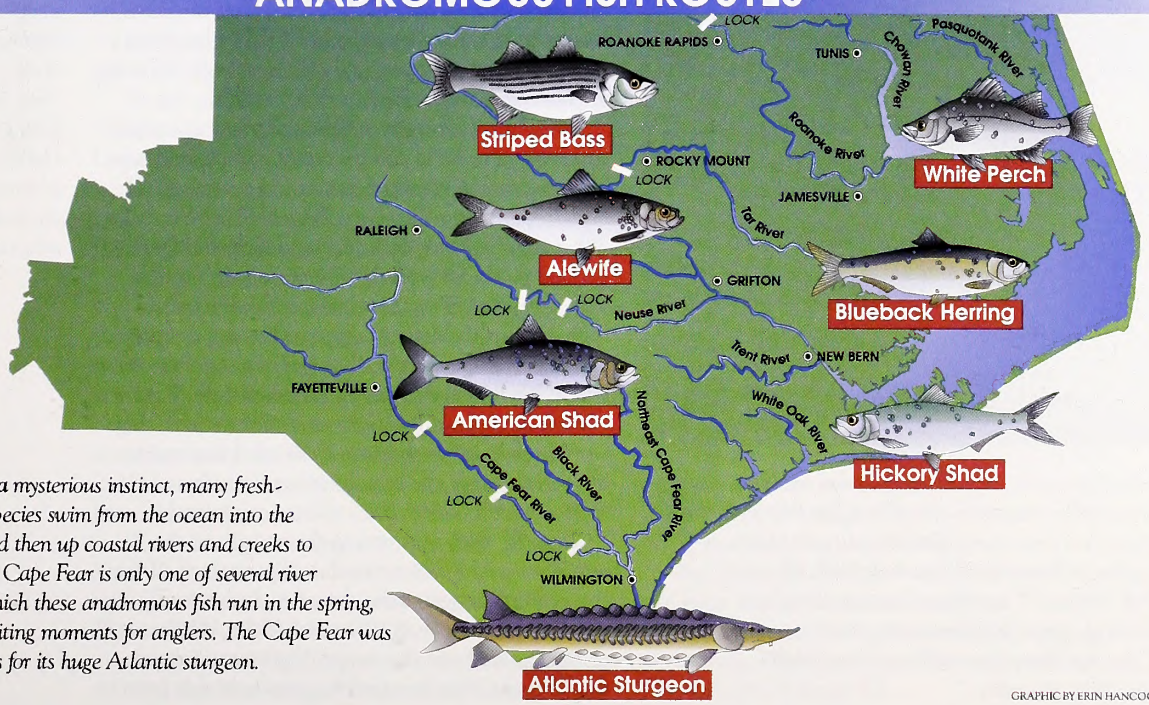
Population: 1,467,984 (1990)

Major land use: Forest

Atlantic drainage

States flow through: N.C.

ANADROMOUS FISH ROUTES



GRAPHIC BY ERIN HANCOCK

Following a *mysterious instinct, many freshwater fish species swim from the ocean into the estuaries and then up coastal rivers and creeks to spawn. The Cape Fear is only one of several river basins in which these anadromous fish run in the spring, creating exciting moments for anglers. The Cape Fear was once famous for its huge Atlantic sturgeon.*

F. EUGENE HESTER

Mallards flush *from a flooded slough in the Piedmont portion of the Cape Fear. Near the Triangle, lakes Jordan and Harris offer wintertime sport for the dedicated urban waterfowler.*

Volunteers are *the mainstays of several organizations that monitor the health of the Cape Fear. Representatives from several of these groups are photographed at Raven Rock State Park. From left are: Dick Harrison, Deep River Coalition; D. Bouton Baldridge, Cape Fear Riverkeeper; Don Freeman, Cape Fear River Assembly Inc.; Kim Colvin, Haw River Assembly.*

Upstream, Downstream

A river is a system. Things are connected. They change and are changed by each other, and the results aren't always predictable. What happens upstream, for example, even far upstream, directly affects the quality of water downstream.

One day a Greensboro developer clear-cuts a streambank to build an apartment complex. It rains, long enough to saturate the drainage system. The banks erode into the Cape Fear. Meanwhile, from a thousand parking lots and roadways and fresh-plowed fields, all sorts of things run off into the water: oil, gasoline, transmission fluid, fertilizer high in phosphorus, nitrogen and sulfur, animal waste rich in ammonia. The pollutants cling to the sediments and hitch a ride downriver. Were it not for all the eroded sediment in the water, they would settle to the bottom in small doses and be filtered through the biological mechanisms of the river—which dilutes their effects considerably.

Instead, they are carried downriver on the sediment in the fast current—unprocessed. When the pollutants get to the slow, flat, meandering part of the river in the Coastal Plain, all that sediment darkens the water. Light cannot get down to the bottom-dwelling plants which form

a nursery habitat for juvenile fish. The plants die. The juvenile fish die.

The bottom becomes toxic. The benthos—those little organisms at the bottom of the food chain—ingest the pollutants and when fish eat them they die. The freshwater mussels die.

In the estuary, almost 2 million cubic yards of sediment accumulate on the bottom, along with lethal concentrations of fertilizer chemicals, heavy metals and whatever else has floated down the river, right in the middle of the primary nursery area. And as if that weren't bad enough, taxpayers will pay the U.S. Army Corps of Engineers to remove almost a million cubic yards of silt from the river channel off the state port and another million cubic yards off the ocean bar at the mouth of the river. That's two football fields, cubed. Every year.

"This material is not coming from local sources—it's coming from up the river," says Corps biologist Bill Adams.

It's all connected. So now farmers in the Piedmont are experimenting with no-till agriculture, farming that doesn't tear open large bald parcels of riverfront land and leave it ripe for erosion. Many municipal sewage treatment plants are updating their equipment, filtering to higher standards. Scientists are recommending riparian buffers—swaths of green space abutting stream banks to filter out sediment and toxins, though they are not yet required in the Cape Fear basin.

The State of the River

On a drizzly day, I accompany Dr. Michael Mallin and two other biologists, Matt McIver and Scott Ensign, upriver on the *R/V Sturgeon*. Mallin, who teaches at the University of North Carolina at Wilmington, has steady blue eyes, longish blond hair and a casual manner, and like most scientists he would rather be out in the field than sitting in an office. He's a passionate advocate for the river. At least four days of every month for the past five years, he's been on the Cape Fear.

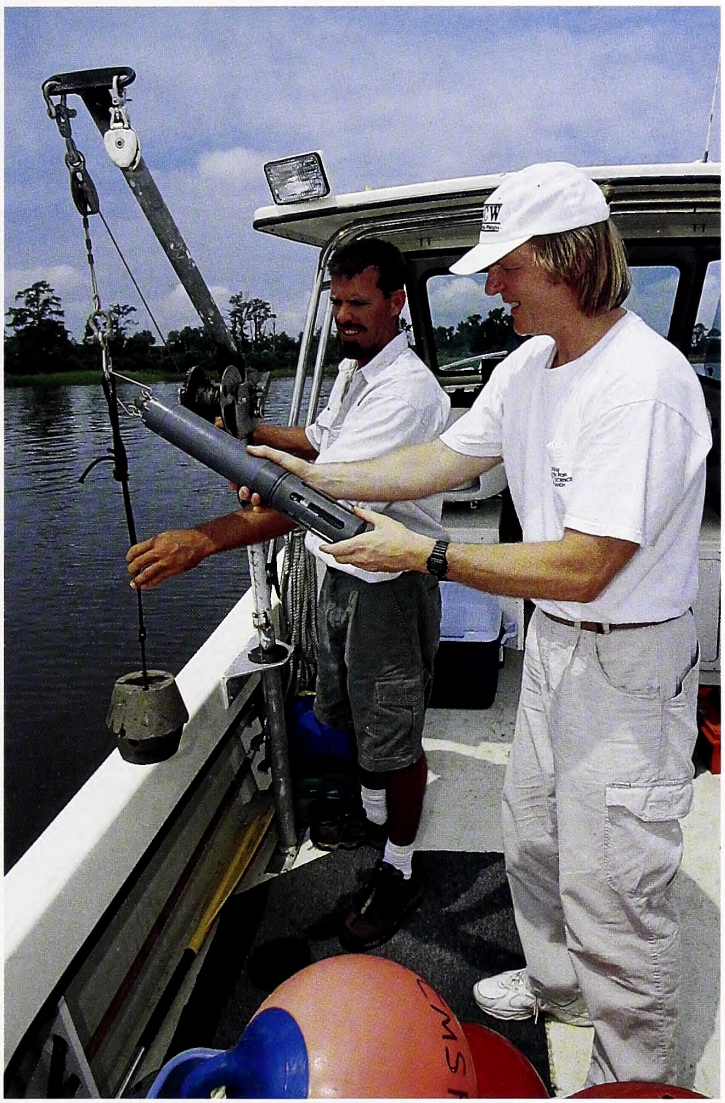
Today we'll sample the river at seven of their 35 stations, including stations on the Northeast Cape Fear and the Black.

Mallin eyeballs the water above Wilmington. "It doesn't look like there's been a big rainfall in the Piedmont," he says. The water is too clear.

The river is flat and sheeny, and the rain swirls across its gunmetal surface. As we speed upriver, the rain comes in torrents. Mallin's team has been out here when the river was so foggy they couldn't tell where the water left off and the air began. In the summer, they'll go out every week to critical stations. With the heat comes more danger to the river, since warm water can hold less oxygen than cold.

We start the sampling at the farthest point—N.C. 11 is almost 40 miles above Wilmington—and then work downriver, detouring onto the Black and Northeast Cape Fear.

At each station, Ensign lowers overboard a sensing unit the size and shape of a Thermos bottle. Various probes on the unit measure dissolved oxygen, turbidity, salinity and pH—at the surface, at the bottom and at the middle depth. Ensign calls out his digital readouts to Mallin, who logs them. McIver fills a collection of bottles with water samples to be analyzed later for nutrients, heavy metals, fecal coliform bacteria and algae.



***Researchers** Mike Mallin (right) and Matt McIver sample Cape Fear water for harmful levels of pollution. Like its ill-starred neighbor, the Neuse, the Cape Fear River has also been heavily affected by the ills of urban growth.*

Then McIver measures light attenuation—how much light is getting through to the bottom growth.

We drift back toward the Cape Fear, listening to the racket of birds and the soughing of the wind through the trees. The rain has quit, the sun finally burning out a hole of blue sky. We delay starting the engine—nobody wants to go back just yet.

Mallin says, "It's not in bad condition, compared to the Neuse and the Pamlico, but it's right on the edge. Continuing watershed development and the removal of the wetlands will push it over the edge. The wetlands are what really is saving the Cape Fear."

But today Mallin can read the story of the river in the numbers: turbidity is 15—low. The other numbers confirm it: Today, despite everything, the Cape Fear River seems to be in pretty good shape. ⊠

a glide in the woods

Just south of the town of Maysville, on N.C. 17, there's a pretty little campground to the side of the busy highway. The manicured lawn surrounds a cluster of manmade ponds and a stand of young cypress trees so neatly spaced as to appear artificial. Unless you look carefully, you will miss the stream running along the back edge of the campground. It hardly looks like a place to start a canoe trip, but this is the put-in for one of the finest blackwater runs in the state—the White Oak River.

The White Oak is part of a basin of the same name that includes the New (coastal version), Newport and North rivers, as well as Bogue and Core Sounds. Each of these rivers has some admirable characteristics, but none can match the White Oak for scenery, water quality and ease of access. In particular, the 9-mile stretch between N.C. 17 and Haywood's Landing is perfect for a one-day canoe trip.

With the permission of the campground owner, my friend David and I set our canoe in the tannin-stained waters and head downstream. An early frost has cleared the air of mosquitoes, but the trees are still green and the air temperature is mild. In the first mile, the White Oak passes through a chain of small lakes, the remains of a quarrying operation that took place right in the river channel. Time has softened the scarring of the riverscape, but we are grateful to finally enter the swamp forest that surrounds the White Oak for most of its length.

There's something magical about canoeing through a swamp forest. Eyes rest easy as you enter the tunnel of green. With no high banks to block the view, your gaze travels far through the understory. Maybe a deer will materialize among the tree trunks, maybe a wild turkey. The closeness of the forest and the hushed sounds bring a feeling of intimacy. It's like a walk in the woods, but in a canoe you are gliding, silent, effortless—a creature at one with your surroundings.

A heavy-set bird takes wing from a low-hanging branch and disappears around a bend in the river. "Look at that!" I call from the bow. "I think it was some kind of hawk."

"Let's keep quiet," David says. "Maybe we'll see him again."

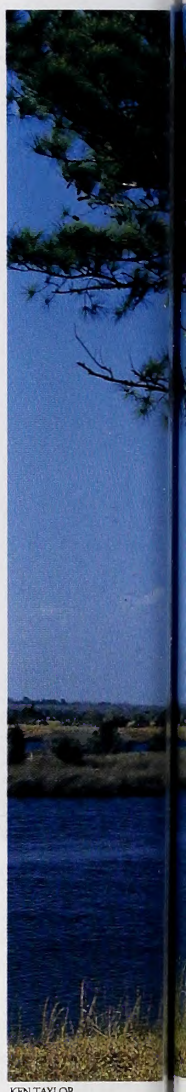
Sure enough, as we round the bend, the bird sits perched on a red maple that arches over the river. It's a barred owl, head hunkered forward to get a better look at these intruders. A few delicate strokes and we rest our paddles. Thirty feet, 25, 20, 15... we glide so close I can scarcely believe it. The owl looks me straight in the eye, trying to discern my intentions. As we pass beneath, it finally spooks.

David lets out an audible sigh. "That makes the trip right there," he says. "We can turn around and head home."

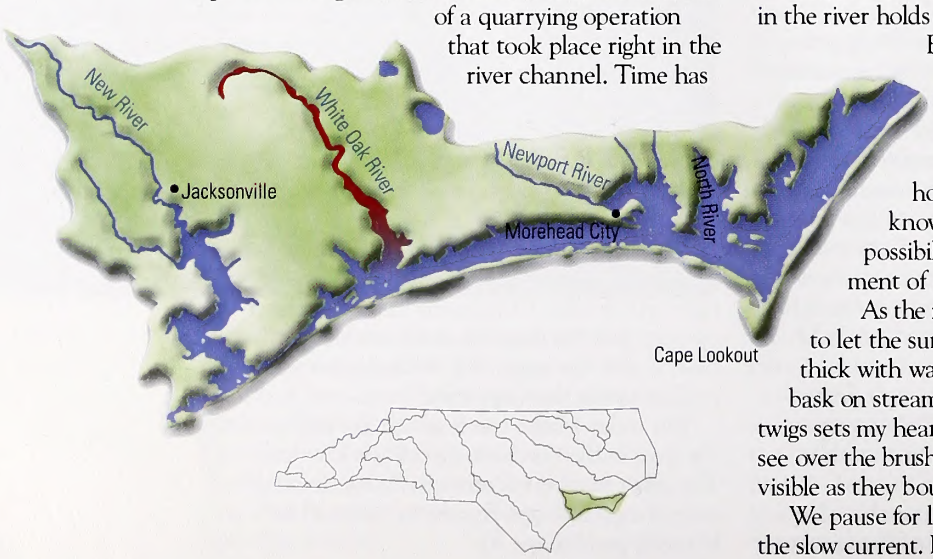
But, of course, we continue onward. Each bend in the river holds the promise of another surprise. Bounded by Croatan National Forest on one side and Hoffman State Forest on the other, the White Oak watershed harbors many species of wildlife. I'm hoping to see a bear, although I know the chances are slim. Just the possibility of seeing one adds an element of excitement to the trip.

As the miles pass, the river widens enough to let the sunlight in. The understory grows thick with wax myrtle and yaupon. Turtles bask on streamside logs. A sudden snapping of twigs sets my heart racing. I stand in the canoe to see over the brush. It's a doe and fawn, white rumps visible as they bound off into the dark forest.

We pause for lunch, letting the canoe drift with the slow current. David says he wishes we'd brought



KEN TAYLOR



WHITE OAK RIVER BASIN

WHITE OAK RIVER BASIN FACTS

Atlantic drainage

Size of watershed: 1,233 square miles

Total mileages: 267 miles fresh water; 192 square miles salt water

Major Tributaries: New, White Oak, Newport and North rivers; Bogue and Core sounds

Municipalities: 14

Population: 194,802 (1990)

Major land use: Forest

States flow through: N.C.

***This bend** in the White Oak River is located near Stella in Carteret County. Deer, black bears, barred owls and tricolored herons (right) are among the wildlife that can be glimpsed in the river.*

the fishing rods. I say I don't think these blackwater streams support a lot of game fish. The truth is, I was in too much of a hurry and left the rods in the garage. I can only hope that a bass doesn't emerge from the depths and snatch one of the dragonflies flitting around the arrowroot plants.

In mid-afternoon, we arrive at the juncture with Holston Creek, and the river widens again. Cattails line the banks, a perfect environment for fish. Like clockwork, a john boat appears moving slowly along the shore. David asks how the fishing is.

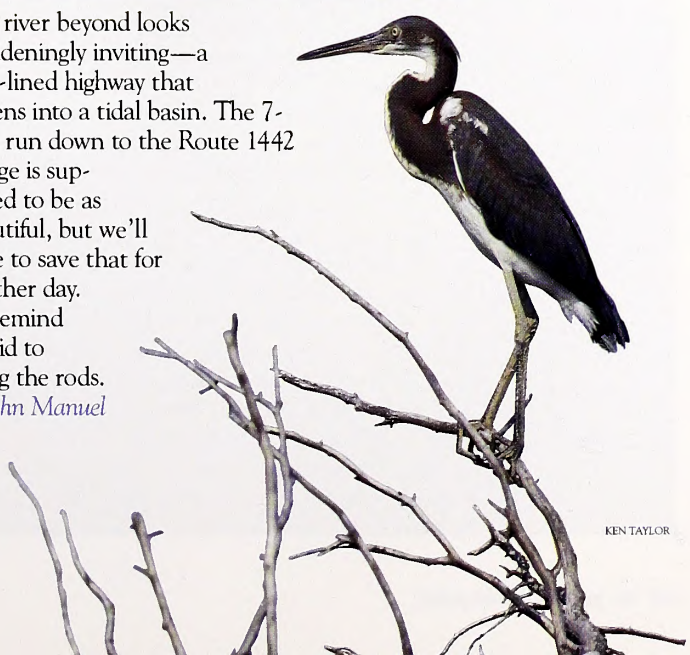
"Real good," says the man in the Marine Corps hat. "I've caught a bunch of nice bass. They say there's even some stripers in here."

I can feel David's eyes boring into my skull. "Don't say anything," I mumble over my shoulder.

"Yeah, next time, let me do the planning."

All too soon, we arrive at Haywood's Landing. The river beyond looks maddeningly inviting—a tree-lined highway that widens into a tidal basin. The 7-mile run down to the Route 1442 bridge is supposed to be as beautiful, but we'll have to save that for another day. I'll remind David to bring the rods.

—*John Manuel*



KEN TAYLOR

River through Time

WACCAMAW

Daddy and I never spent enough time together—that we both could agree on. During my youth, he was always so busy running a bustling law practice and dividing his attention among five children and a wife that he had little time to spare for his only son. To tell the truth, I'd never had my father to myself. So when I asked him to join me on a canoe trip down the Waccamaw River, I didn't really expect him to come along. The trip would mean at least several days away from his office and his wife. And neither of us had ever done much canoeing, much less a 60-plus mile journey through a swampy wilderness.

written by Rodney Foushee

photographed by Melissa McGaw

But the trip meant a great deal to me, and I was hoping Daddy would find the time. Growing up near the Waccamaw just south of the state line in South Carolina, I had spent many a day and night on this crooked river. From a small wooden boat on the Waccamaw, I learned how to flip crickets with a cane pole to avoid the overhanging branches and catch plump bream. It was on the same river that I learned to set hooks on green limbs for catfish in spring, shoot bullfrogs in the sloughs by flashlight in summer and hunt wood ducks in winter. I had been on the river dozens of times as a youth, but I never ventured more than few miles upstream by boat from our launching site at Bellamy's Landing where S.C. Highway 9 crosses the river. Downed trees and snags had always halted our progress. I often wondered where the dark waters of this river came from that disappeared into the swampy forest upstream.

Fifteen years later, I wanted to find out and I wanted Daddy to join me.

So I was pleasantly surprised when he answered emphatically—"Yes! Absolutely yes!" We would have to wait for the spring freshets and higher water to start our journey. But that was fine—it gave us both something to look forward to.

• • •

Arising in the southeastern corner of North Carolina, the Waccamaw River emerges from Lake Waccamaw near Whiteville and slowly flows south through the massive Green Swamp before turning southwest to form the Columbus/Brunswick county border as it snakes its way back and forth to South Carolina. This North Carolina stretch of the river is about 60 miles long. Owing to no legal boundaries, the river continues on for another 70 miles into South Carolina, widening and becoming a tidal river before joining the Pee Dee River and finally entering the Atlantic Ocean at Georgetown, S.C.

Because it originates wholly in the Coastal Plain, the Waccamaw is a true blackwater river.

father and son

The water, actually the color of dark tea, is nearly sediment-free and would be absolutely clear, if not for the staining of tannins, an acidic byproduct of the decay of millions of leaves and organic matter from surrounding swamps. Except for a small concrete spillway at the lake built in the 1940s, the Waccamaw is a free-flowing river—a rarity in North Carolina. There are no other manmade structures to impede its meandering course to the sea. Intact as it is, the river is home to a rich assortment of wildlife—from alligators, cottonmouths, turkeys and bears to a half dozen or so fish and mussel species that are found nowhere else in the world.

Some consider the Waccamaw North Carolina's most beautiful river. Though beauty lies in the eye of the beholder, the Waccamaw is surely one of the state's wildest rivers. It's not that the river is pristine—human hands armed with crosscut saws definitely left their mark. Millions of board feet of timber were rafted from the river's great swamps before the supply of virgin cypress and juniper was finally exhausted early in this century. But once the logging boom ended, the Waccamaw settled back down into a sleepy backwater that time has mostly forgotten. The wildness of the Waccamaw lies in its unbrokenness—there are no towns and just a sprinkling of communities—places like Crusoe Island, Old Dock and Pireway—along the entire North Carolina stretch of the river. But mostly the river is alone with itself.

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Daddy and I arrived at Lake Waccamaw Friday morning, March 19. The drive around the lake

Waccamaw River

was pleasant this last day of winter—the weather was mild with high pressure building in and the daffodils were in late bloom around the well-kept lake houses. We were both impatient to begin.

We headed down the little sandy drive at the end of the paved road to the low, concrete dam. A local man, in his late 60s or early 70s, was busy balancing himself on the submerged dam, casting a beaten-up plug for bass in the turbulent water where the calm lake suddenly became a flowing river.

The view of the river from the dam was disappointing, though. You couldn't see more than 50 yards before the water disappeared into a forest of cypress and tupelo.

"What's the river like down there?" I asked the fisherman, pointing into the dense swamp forest. I had spied a small, handmade wooden boat in the bed of his beat-up Ford.

"Don't know," he said matter-of-factly. "I done lived here all my life and never been more than a quarter mile down river."

This perplexed me.

"Didn't you ever wonder what was down there?" I asked.

"Nope," was his firm answer.

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A little after 8:30, we shoved off from the sandy bank and were in the river. With food, water, clothes and assorted camping equipment filling every nook and cranny in the canoe save the two wicker seats and room for our feet, I couldn't help but marvel at this tiny craft we were going to spend the next four days in. The river was open to the sky for 30 seconds or so with the lake at our backs, then it quickly disappeared as we were swallowed up by a swampy cathedral of trees. The Waccamaw is little more than a creek as it leaves the bounds of the lake and begins a twisting journey southward through the expansive stretch known as the River Swamp.

We'd canoed for no more than five minutes on this creek of a river, when we hit the first deadfall—an impressive tupelo uprooted by Hurricane Bonnie not long before. The tree spanned the entire river and then some; its massive wad of roots lay on the right bank, still clinging to the spongy, black soil. The top of the tree, a mass of branches with withered brown leaves that were full of life just a few months before, was on the left. The river kept on flowing just under the massive tree trunk, at least 4 feet in diameter at the base, lapping at the bark of this fallen Goliath.

We had no choice but to portage around this obstacle. Though the river was high, it could get much higher and had been so just a few days earlier, as evidenced by the waterline on the towering bald cypresses all around us.

We carefully chose a landing spot on the left bank, just above the fallen treetop. I cautiously exited the canoe, making my way onto the boggy soil, and pulled the canoe ashore.

Considering the time it had taken to load the vessel, we decided to drag the canoe fully loaded overland. With short successive pulls we inched several hundred pounds of food, gear and canoe over the spongy, leaf-strewn floor, banging the canoe all the way through a maze of unbending cypress knees. It was 15 minutes before we finally eased the canoe back into the river 20 feet downstream.

Each successive deadfall—there would be a dozen more this afternoon—proved to be a puzzle for us to solve. We learned to pull the canoe over the heavy trunks when they were low in the water, or slide the canoe under boles that were exposed by the falling river—often exiting the boat in the process. Our third option was to cut our way through using a $15 bow saw hastily purchased at Wal-Mart the night before, always taking care to select the smallest branches to get the job done. With each fallen tree, our confidence as a team rose. The canoe was full of broken limbs and our arms were scratched and worn tired from sawing, but we never again portaged the canoe—we were both proud of that.

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We were likely the first humans to travel this section of the river since the hurricane blew through six months before, but it could just as easily have been a thousand years before. The first pair of wood ducks, in brilliant breeding plumage, sounded an alarm, taking to the air no more than 30 feet ahead of the canoe. A few hundred yards later, a family of river otters honored us with their presence. Four dark humps peaking just above the water's surface moved in unison not 15 feet ahead of us, before a snakelike head finally rose out of the water and stared me down briefly with its beady eyes.

Wood ducks kept coming in the half-light of the River Swamp—maybe a dozen pairs or more. Paddling through a sea of deadfalls, I saw something move out of the corner of my eye. The quick body registered in my mind as a fox, but

LUMBER RIVER BASIN FACTS

Atlantic drainage

Size of N.C. watershed: 3,343 square miles

Total streams and rivers: 2,283 miles

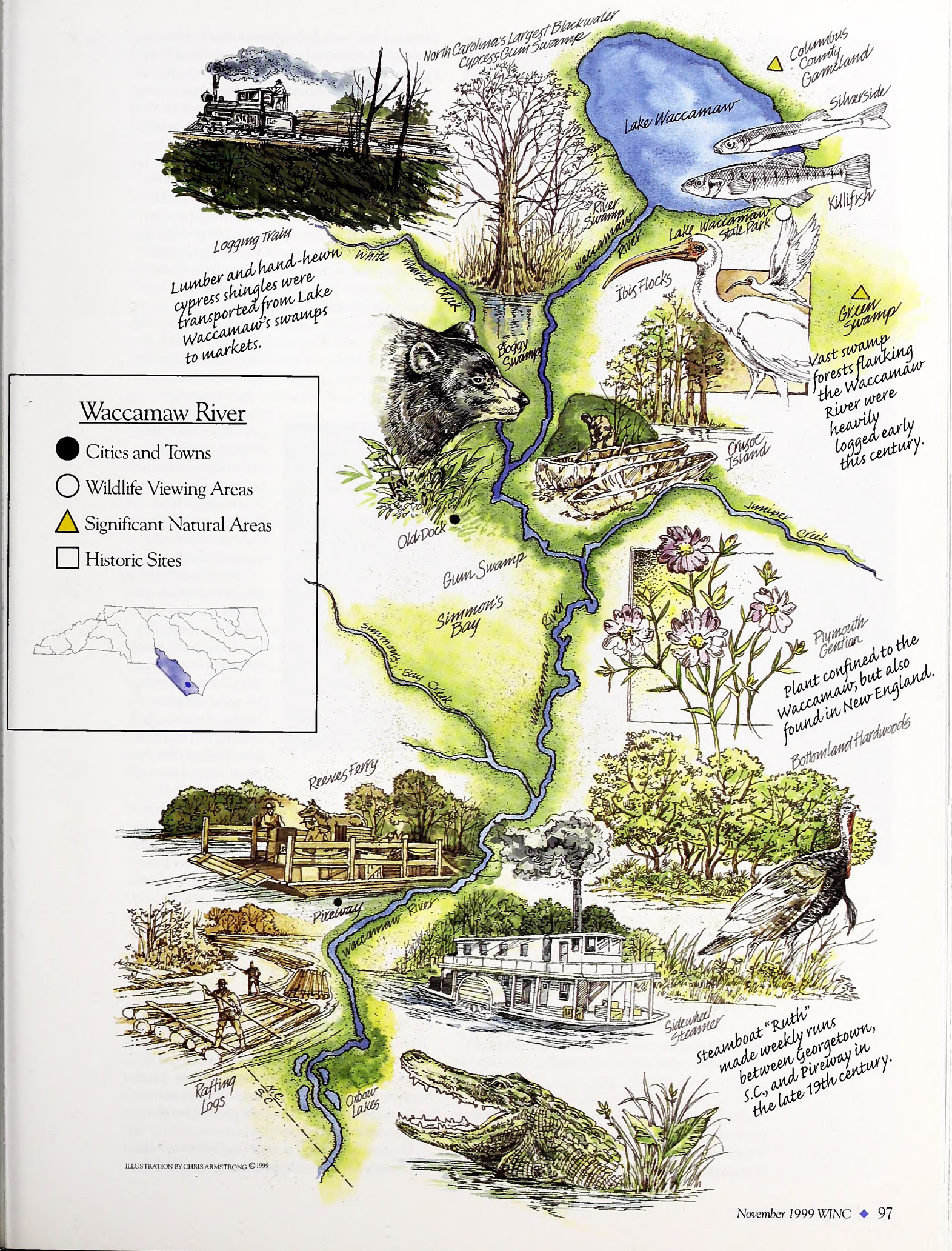
Major tributaries: Lumber River, Waccamaw River

Municipalities: 50

Population: 259,539

Major land use: Forest

States flow through: NC, SC


North Carolina's Largest Blackwater Cypress-Gum Swamp
Columbus County Gameland
Lake Waccamaw
Silverside
Killifish
Logging Train
Lumber and hand-hewn cypress shingles were transported from Lake Waccamaw's swamps to markets.
White Marsh Creek
River Swamp
Waccamaw River
Lake Waccamaw State Park
Ibis Flocks
Green Swamp
Vast swamp forests flanking the Waccamaw River were heavily logged early this century.
Boggy Swamp
Crusoe Island
Juniper Creek
Old Dock
Gum Swamp
Simmon's Bay
Simmons Bay Creek
Waccamaw River
Plymouth Gentian
Plant confined to the Waccamaw, but also found in New England.
Bottomland Hardwoods
Waccamaw River
Reeves Ferry
Pireway
Waccamaw River
Sidewheel Steamer
Steamboat "Ruth" made weekly runs between Georgetown, S.C., and Pireway in the late 19th century.
Rafting Logs
N.C.
S.C.
Oxbow Lakes
Waccamaw River
Cities and Towns
Wildlife Viewing Areas
Significant Natural Areas
Historic Sites
ILLUSTRATION BY CHRIS ARMSTRONG ©1999

the movements were not quite right. A bobcat bounded from the top of the blowdown and disappeared into the swamp.

We didn't stop for lunch—not knowing how far we'd really come through this twisting maze of cypresses, and how far we had to go. Around 1:30, we reached open sky and an overhead power line—the first sign of civilization since we departed the lake. An egret eyed us from the reedy edge, then flapped slowly away. The openness was fleeting as the Boggy Swamp—as this stretch was marked on the topo map—quickly engulfed us. Judging by the narrow diameter of the trees, this area must have been logged more recently. As the blowdowns resumed, we began to find small cut-throughs in the downed trees. These openings were just large enough to allow the passage of a small canoe. From the smooth finish of the cuts, we knew they were made with a chainsaw.

Someone had taken great care to make the going a lot easier on this stretch of the river. And after squeezing through each successive opening, we thanked this phantom woodsman.

Around 4 o'clock, we reached a burned-out, single-track wooden bridge heavily coated in creosote. It had once carried the weight of heavy logging equipment that helped haul choice cypress trees out of this vast swamp and away to Hallsboro. The tram road, basically a raised dike, was constructed by piling up sandy muck from the swamp until it was no longer underwater. We made our camp up on the high roadbed.

prothonotary warbler

With the heavy smell of yellow jessamine in the air, we ate military rations and took in the evening in this wonderfully wild place. A fresh bear track was plainly visible in the white sand no more than a dozen paces away. Leaning back on our packs, we watched the darkening sky transform from red to pink as the sun melted into the Boggy Swamp. As if on cue, a flock of 100 or more white ibises whirled overhead out of the treetops and disappeared into the swamp as the mating songs of a thousand frogs joined in on the evening performance. We'd traveled maybe seven miles in this swampy region and were pleased with what we'd found.

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We reached Crusoe Island, the first substantial piece of high land on the Waccamaw, at 9 o'clock the following morning, and Thomas Spivey was there to greet us. Spivey, a middle-aged man with straight, black hair, dark eyes and chiseled features, waved us in as we proceeded to his low house up a channel that broke to the left off the main river. He busied himself clearing out a wide hole among a jumble of assorted boats at the water's edge to make room for our small craft. A mixed-breed black dog barked incessantly from behind him in a large homemade pen.

"Come on up, come on up," he said over the noisy dog, as if we were expected guests. Daddy handled the introductions, explaining where we came from and where we intended to go. Spivey seemed genuinely impressed that we had made it from the dam, with all the downed trees in the river. "I know it's bad above the power line, I do," he said. "It must be terrifying."

Situated on the edge of the Green Swamp and nearly surrounded by water, Crusoe Island is fittingly named. No one knows the exact origins of the original inhabitants of this remote low ridge, but one of the stories is that they were people of French origin who fled from Haiti in the late 1700s and ended up in the Green Swamp. Their descendants have lived on the island in near isolation for nearly 200 years.

Spivey was born on Crusoe Island, and he was married and raised two daughters here. He made his living in the swamps, catching snakes, trapping, hunting and fishing. At times, he had worked as a dragline operator, but he never strayed far from the reaches of the Waccamaw. Though he made no claim of ownership, this was his river. And he confirmed my suspicion that he had been the one who cleared the way for us below the power line, drowning out two chainsaws in the water in the process.

"I cut the river for the canoers, mainly," he explained. "I'm going to do my best to get the river cleared out wide enough to get a canoe through," he said. He was favoring his left side and there was pain in his hard face.

At 53, Thomas Spivey had lung cancer, and the disease had spread into his ribs and shoulder. "It's no good," he said. "It's got me in bad shape."

There was a time when Spivey spent the entire day on the river fishing and clearing snags. But now he could only spend a half-hour at a time on the river with the chainsaw before the pain became unbearable.

Despite his care, the river had taken its toll on Thomas Spivey—he was missing half his front

teeth from a run-in with a bay tree some years back. The downed tree, bent low in the water by the weight of another branch, sprang to life as he cut it, dislodging his teeth as it slammed into his face. With the boat covered in blood and teeth, Spivey motored his way back to Crusoe and drove himself to the hospital, some 10 miles away. That bay tree almost cost Thomas Spivey his life.

"Please look at the bent limb," he implored. "It's better to cut it high—even four or five times—than to have it jump back on you. Don't trust the bent limb; it's just like a crooked man, it'll hurt you."

Behind Spivey was his shop, a rough shed adorned with deer antlers and topped with a rusty tin roof. Rusting traps, tires, scrap wood and barrels were scattered about. A handwritten sign warned visitors that he was not responsible for any accidents that occurred on his property. Spivey had developed a reputation for his woodworking skills, carving wooden dough bowls, benches and swings from ancestral tools passed down through the decades. He carved countless bowls and benches in his life, but building log boats was his specialty.

The simple design of one of these dugout boats masked the skills it took to build it. The hardest part, Spivey relayed, was finding a cypress log that was big enough to work with. All of the old-growth trees had been logged away decades ago, but there were still massive timbers on the river bottom that had been lost when a poorly loaded raft broke apart, spilling its contents into the river. Generations after the trees had been cut, Spivey would pull the rot-resistant cypress out of the river ready for use.

The logs were split and then hollowed out with a long-handled adze—a hoelike tool with a sharp edge—to form a boat. Spivey volunteered to demonstrate the log boat's use for us. And despite his pain, he paddled the craft effortlessly through the canal.

"As far as hunting boats are concerned, you won't find a better boat," he said, deftly exiting the narrow craft using two short paddles for support. He could shoot a nice swamp buck from the boat and haul it back home with freeboard to spare.

I queried him about fishing, telling him of my plans to set some catfish hooks on green limbs along the river. "You bring any bait with you?" he asked. He reeled in disbelief when I told him I planned to bait the hooks with Ivory soap as I learned as a youth.

"Aw-w-w, that boy's in the wrong place," he said, grimacing at my father. "You can't catch no catfish with soap."

Spivey motioned me into the shed, where he produced a croaker, already cut into small pieces. "Just put a piece of croaker fish on the hook about the size of your finger," he said. "That'll catch a catfish." I thanked him and told him I'd test the croaker against my soap. He ignored the comment, paused and continued: "Anytime you want to come back and stay—you can come and stay up here for a month, six months or a year—I don't care a bit."

We shoved off and were in the river, and

Thomas Spivey

then Thomas Spivey yelled back at me from his island kingdom with a wide grin. "Soap's made to wash with, not to fish with!" his words echoed into the swamp.

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Spivey had predicted that the river would alter after joining with Juniper Creek, and it did, becoming wider with higher banks. The forest also changed from the swamp mix of tupelo, gum and cypress to a medley of laurel oaks, overcup oaks, loblollies and juniper. Most striking were the majestic live oaks and saw palmettos on the highest points. These were familiar coastal plants to me, especially the

Saving a WATERSHED

The Waccamaw River represents one of the finest examples of a blackwater river in North Carolina. At the river's headwaters, Lake Waccamaw is one the largest water-filled Carolina bays in the state and is home to several globally rare fish and mussel species that include the Waccamaw darter and the Waccamaw spike. The River Swamp below Lake Waccamaw, home to alligators, snakes, black bears and a variety of waterbirds, is the largest remaining blackwater cypress-gum swamp in the state. But it is the wild, unbroken nature of the river that is most valuable to wildlife. This forested corridor allows everything from warblers, wild turkeys and bears to move freely throughout the watershed.

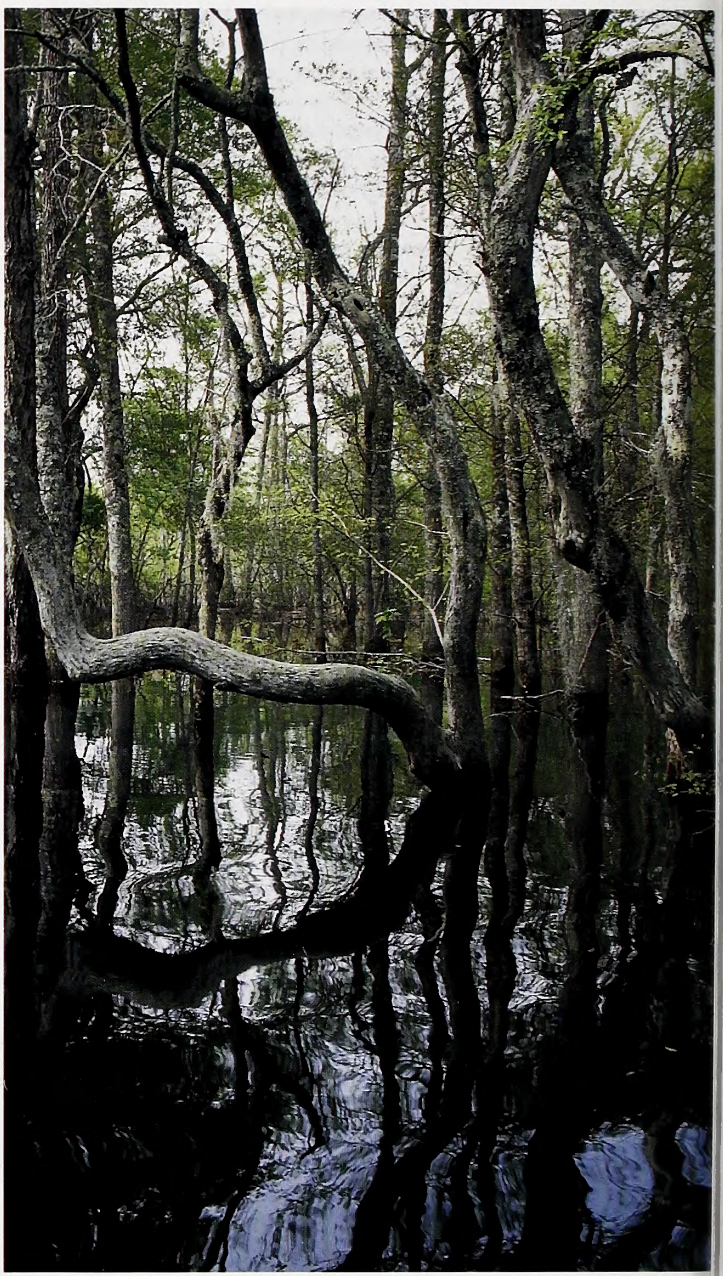
Though there are few areas of development on the banks of the Waccamaw in North Carolina, the river's unbroken nature is deceivingly fragile. From the air, pine plantations, agricultural fields and homes line the highlands and encroach near the river. And new housing developments and clear-cuts are under way.

Though the river has no organized group to look after its welfare, efforts are afoot to preserve the wild state of the river. The headwaters of the river, including the lake, are included in Lake Waccamaw State Park and the Columbus County Game Land. Along the lower river in South Carolina, the massive new Waccamaw National Wildlife Refuge is being created, which will eventually encompass 50,000 acres of wetlands. And South Carolina has already purchased much of the land along the middle stretch of the river and designated it as a state Natural Heritage Preserve.

However, nearly all of North Carolina's portion of the river—more than 50 miles—is in the hands of private timber and investment companies.

"The Nature Conservancy has been very active along the South Carolina stretch of the Waccamaw to protect a wildlife corridor," explains The Nature Conservancy's Merrill Lynch, with the North Carolina chapter. "In North Carolina, the Waccamaw River has been one of our highest priority natural heritage areas for many years. We hope to protect a wildlife corridor along the river from the headwaters here down to the state line."

Recently, The Nature Conservancy got the ball rolling with a series of meetings between local land trusts and interested landowners to develop a landscape-scale preservation effort to tie together the lands already protected in South Carolina with those in North Carolina. "There are few rivers left that are free-flowing like the Waccamaw," Lynch explains. "With the Waccamaw, we have a great opportunity to protect an entire watershed from the headwaters to the estuary."



backwater swamp

palmettos. My cousin and I were often tasked, as boys, to collect the branches from the swamps for the Palm Sunday church service.

We chose a fine, sandy bank near Freeland to pitch our tent as our second evening rapidly approached, and I busied myself setting catfish hooks while Daddy worked on a fire. The stars were just peering out of the blackening sky when I heard the splash of the first fish in the darkness. Our aching bodies settled into an uneasy slumber with the struggling of catfish in our ears.

Our restless sleep was broken around 2:30 with bright flashes of lightning and the growl of thunder deep in the swampy bowels of the river. Rain pelted the tent as Daddy and I struggled for some much-needed shut-eye.

The rain slackened enough at daybreak for us

to hastily pack our gear and check the set hooks. Spivey's croaker fish had beaten my Ivory hands-down, catching three catfish and a large bowfin. But my soap had also landed a catfish. In no mood to clean fish, I hastily cut the wriggling creatures free. We dug the paddles in for the longest day of the journey.

Bolts of lighting etched across the angry sky as we hunkered down under ponchos and paddled into a driving rain. The threat from lightning was deadly real on this stretch of river as evidenced by the black scars on many of the tall oaks we passed.

The lightning and rain came and went as the miles melted away beneath us. During one of the dry spells, we came upon a father and his three sons bank-fishing for bream. They were from Whiteville and hadn't caught much so far.

"Nice motor you got there," the eldest angler joked, motioning to Daddy with his paddle in the rear of canoe. I was busy taking photographs, my paddle conveniently laid across my lap.

"It might be a little old, but it hasn't failed me so far," I joked back as we eased by their floating corks.

We arrived at Pireway around 4 o'clock and the river widened out to nearly a lake in this ancient river course. Sidewheel steamers had once made irregular trips this far upriver from Conway and Georgetown delivering supplies to the few inhabitants of this region. There were some new houses going in on the left just below the N.C. 904 bridge—they were the first new buildings we had seen on the trip. We leaned into the nasty, swirling wind to put miles between us and this semblance of civilization.

The river tightened down once again as we entered CawCaw Swamp, another low swamp with a surplus of willows and short on high land. It was dusk before I finally spotted a small hammock just off the main river and we put ashore. I dubbed this place Four Pine Island in honor of its three upright loblollies. A fourth massive pine had been smashed over by the wind and its needles were reddened and dead. Daddy built a smoldering fire with pine needles and resinous branches as a howling wind cut through the upright pines.

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We awoke to a beautiful, crisp morning for the final leg of our journey. A prothonotary warbler greeted us at the state line—at least where I guessed it was—around 6:30, and abruptly the ever-bending Waccamaw became familiar to me. I began to recognize individual trees, dead-end sloughs and odd angles in the river from the fog of my past—each attached to a specific memory. I hadn't been on this water in more than a decade but this was the river of my youth, and my father was finally here to enjoy it with me. The distance between us melted away as we marveled at the arching, lichen-covered oaks, the stands of willows and the sloping, sandy banks. In one great bend, we discovered together a bald eagle's nest perched high in the top of a dead pine, the white head of an adult warily watching us as we circled slowly by.

The end of the journey was coming all too fast. I couldn't turn back the persistent flow of the Waccamaw. But at least I could postpone the end by five minutes, I thought. "Let's pull over to that bank and check out the woods," I said. Daddy obliged but decided to remain in the canoe as I strolled through the dry woods, stretching my legs.

Quickly satisfying my curiosity, I eased back into the bow of the canoe—something I had done dozens of times without event during our trip. But here, 61 miles into a 62-mile trip, something different happened. Blame it on a steep bank. As I leaned over to push off with my paddle, the bow hung snugly on the bank and the canoe began to list noticeably to the left. And despite all my efforts to reverse gravity, the canoe continued its slow-motion roll until the left gunwale dipped into the black water and the canoe was swamped.

My father and I scrambled out of the sinking vessel and up the steep bank in a vain attempt to escape. I managed to save the camera strapped around my neck—that was about it. Everything else, including Daddy, was drenched. We dragged the canoe from the icy water and fished our floating equipment from the river. Instead of five minutes, the end of our journey was postponed by nearly an hour as we waited patiently for our clothes and equipment to dry out in the warm Carolina sunshine.

With the river still dripping from our faces, we both burst into uncontrollable laughter. We'd done well; we had made it all the way—well, almost. Best of all we'd closed the gap between us—and that's what really mattered. We vowed to go on another canoe trip again—Daddy and I—and this time sooner rather than later.

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Thomas Spivey passed away in mid-July, but his memory will go down hard on the Waccamaw. He's been appropriately buried next to his beloved river on Crusoe Island. I won't forget what you told me—I won't trust the bent limb, nor the crooked man, Mr. Spivey. And you were right: Soap is for washing. ⊠

the Forgotten Streams

Why shouldn't city kids have a chance to play in clean streams? That's the question that citizens of North Carolina's urban areas are increasingly asking as they consider the sad state of their rivers and streams. We've channelized them, buried them in concrete and rip-rap, and filled them with trash until they've vanished as natural streams. Mecklenburg County is taking the lead in cleaning up its urban streams with a popular program that has won the support of many. Other cities are joining in to restore the health of what some are calling the most neglected waterways in the state.

written by
Chris Powell

photographed
by Ken Taylor

They are the black sheep, the forgotten. In every city and town throughout the state, small urbanized waterways meander anonymously through jungles of asphalt and concrete. Some are small rivers, others are tiny creeks or little tributaries that flow under streets, through culverts and past backyards. Where once they eased through ravines and bordered farms, many of these streams now lead a controlled existence in drainage pipes and concrete riprap channels. Modern industrial life has relegated their uses to natural ditching systems. And for the most part, these waterways have become hidden, lost and abandoned.

But if there is one segment of society who will never let these aquatic outcasts go completely overlooked, it is children. Impelled by powerful curiosities, metropolitan youngsters will forever be drawn to these trickles of nature to chase frogs, collect tadpoles and race homemade boats. Look at most urban streambanks during the summer and you will see adolescent footprints periodically spanning their length. And it's the presence of those footprints along some of our most degraded streams that is sparking recovery programs throughout the state. Concerned citizens who can recollect their own rock-skipping days are beginning to place new emphasis on cleaning up these neglected areas.

One such waterway is Little Sugar Creek, which runs through Charlotte. Little Sugar could be most any stream or branch that has been overrun by development. It begins as a foot-wide, spring-fed brook in the Hidden Valley neighborhood, located north of downtown. Off North Tryon Street it has been channelized with high cement embankments stretching up to the backs of commercialized buildings. Though a lack of rain reduces the water level, the site of numerous storm drains suggests the lazy creek can explode into a raging torrent at times.

Under a rail line, the Little Sugar picks up speed and flows about 5 miles to a greenway called Cordelia Park. Still channelized, the stream widens to 15 feet and curves into Alexander Park and under a rail line, which was the site of a train accident in 1997. David Caldwell, with the Mecklenburg County Department of Environmental Protection, said heavy rains caused the stream to rise and wash out an embankment supporting the trestle. The train was forced to stop along the span, which quickly gave way, sending the abandoned engine into the Little Sugar.

Bordering the stream along the park is the 16th Street neighborhood, comprised of lower-income homes on one side and public housing projects on the other. By the looks of debris that has been deposited high on the banks, some of the houses were built very near the floodplain.

The Little Sugar proceeds south and ducks under Interstate 277, a multilane highway alive

A jagged *skyline of concrete and steel can be seen in the background, as Little Sugar Creek makes its way into downtown Charlotte. The creek seems to stoop and slouch along this rough part of town.*

Relegated to an urban drainage system, the channelized banks (left) of Little Sugar bear no resemblance to what the creek must have looked like in a natural setting. The creek completely disappears in some places, covered over by hundreds of square feet of parking lots and shopping malls (bottom).

with commuters and semis. Soon thereafter, the creek widens to nearly 50 feet and creeps along cement and rock embankments toward downtown, paralleling streets and passing office buildings and businesses. Next, it enters a dark cavern that extends beneath the entire parking lot of the Midtown Square Shopping Center. Fencing has been put up to keep people away, but supposedly a group of homeless people lives beneath the shopping center. The stream then breaks back into the light and continues through 4 or 5 more miles of downtown. Next, it meanders over to the Carolinas Medical Center greenway, which connects to Freedom Park. The park is a pleasant-looking area with swings and basketball and volleyball courts.

Just south of downtown, the Little Sugar travels about 6 more miles through the middle-class suburbs of the Dilworth area. Somewhere along the line the creek has been freed of its cement constraints and almost resembles a natural stream as it proceeds past graffiti-covered pilings. It then merges with Briar Creek, becoming much wider and about 2 feet deep before proceeding to Hunting Towne Farms Park, where a greenway was recently created. The Little Sugar gradually exits through the southern boundary of Mecklenburg County and eventually runs into and becomes Big Sugar Creek, which leads to the Catawba River and finally Lake Wateree.

Though far from untarnished, the Little Sugar is surprisingly free of litter and odorless for a city creek. It wasn't always that way. In the 1960s, it was standard practice for sewer lines to have overflow bypasses that allowed raw sewage to run straight into waterways. Complaints of septic odors on the Little Sugar became so bad that county crews would drip drums of deodorizer into the creek to mask the smell.

Thankfully, those days are long past now, due in great part to the Clean Water Act and the work of the county, which is considered to be in the forefront of the urban-river restoration movement in North Carolina. Like other municipalities, Charlotte has reached this point after decades of steady growth that has contributed to water degradation.

Historically, the problem has been sedimentation and elevated fecal coliform (bacteria) levels, which both can be linked to population growth, said Russell Rozzelle, water-quality program manager for Mecklenburg County Environmental Protection.

"Mecklenburg County has 2,600 miles of sanitary sewer lines and tens of thousands of septic tanks," he said. "All it takes is one blocked man-

"We went to the board of county commissioners and said, 'We've got kids playing in these creeks, and a lot of these waters are significantly polluted.' Our point was we could either post them and warn folks not to go in the creeks, or clean them up."

—Russell Rozzelle

***Though** greenways (above) at least provide a semblance of nature, one can't escape the feeling that the straight, clean-cut look is too perfect. A normal creek has character—twists and turns and overgrown banks.*

hole along a creek and you have elevated fecal levels. And of course, sediment and erosion are big problems, as well. Land-disturbing activity without proper erosion-control measures can cause mud to wash into the creek and carry with it various heavy metals, nutrients and bacteria."

But there are other pollutants associated with urban development. Lawn fertilizers, applied year-round, wash into streams and ditches. Petroleum products and metals from the wear and tear of automobiles are also contributing pollutants.

Combined, all of these factors led to a decline in the condition of Mecklenburg County's streams by the mid-1990s. No longer were these problems just nuisances, they had become public health risks, and the area was faced with a choice.

"We went to the board of county commissioners and said, 'We've got kids playing in these creeks, and a lot of these waters are significantly polluted.' Our point was we could either post them and warn folks not to go in the creeks, or clean them up. And the commissioners chose the latter," Rozzelle said.

In 1996, the Mecklenburg County Board of Commissioners adopted the region's first creek-use policy, which called for all waters to be suited to prolonged human contact. With that directive, the county's Department of Environmental Protection developed the Surface Water Improvement and Management (SWIM) panel. The panel included a wide array of community members to provide stakeholder input. Developers, environmentalists, government employees and ordinary citizens all met and, through consensus, developed the SWIM initiative. SWIM seeks to address a number of issues, ranging from public awareness to stream-monitoring efforts. But the program's most important feature, Rozzelle said, is the buffer plan that was developed. Buffers are vegetated strips of land adjacent to streams. The vegetation's root systems filter out many of the contaminants that otherwise would flow straight into the creek.

In the plan, buffer widths vary based on the amount of acreage a waterway drains. In other words, a 35-foot-wide buffer would be required on each side of a creek or stream that drains 100 acres. Fifty-foot buffers would be required on each side of a creek that drains 300 acres. And on all streams that drain 640 acres or more, buffer widths would be 100 feet, plus one-half the area of the vegetated fringe.

Typically, government policy that limits land use is greeted with heavy opposition from land developers. However, Rozzelle said the buffer plan contained a number of incentives and flexible mitigation options that were more palatable. Moreover, because developers helped design the buffer plan, they believed they were being represented and listened to.

"The developers who sat on this panel helped design the plan through a consensus-building process," Rozzelle said, "so they have been very helpful at communicating the plan to the rest of the community."

Though just in its infancy, SWIM is off to a good start, with $750,000 allocated from the Clean Water Management Trust Fund matched

***Entering** Freedom Park (top), Little Sugar Creek meanders under walkways and past volleyball courts. It later connects to Briar Creek (right), before flowing past a wastewater treatment facility (bottom).*

by a similar amount from the city and county, Rozzelle said. One of the program's first projects will involve shoring up Edwards Branch, which lies in a small drainage basin in a very urbanized area.

"We're going in and we're retrofitting some buffer systems and some wetlands and installing a greenway and a nature trail and some educational centers," Rozzelle said. "We want to show what SWIM can do if it's done right."

Mecklenburg County is also continuing to push its 10-year-old Adopt-a-Stream program. At present, more than 85 miles of streams have been adopted by 37 different community groups that include more than 500 citizens. These volunteers have removed hundreds of thousands of pounds of trash from Charlotte's creeks.

A Rising Trend

Already, other cities are beginning to take equally hard looks at their own urban waterways. The city of Raleigh recently initiated an Adopt-a-Stream program, whereby volunteers can keep an eye on nearby creeks or tributaries.

"What we ask volunteers to do is to walk about a mile section of stream twice a year," said Mac Smith, a water-quality technician with the city's Stormwater Management Division. "They then look for problems such as erosion, pollutants or anything that doesn't look right or that may smell funny."

At present, about 300 people have volunteered to oversee approximately 35 miles of streams. Many of the volunteers are from environmental groups and programs such as the Boy Scouts of America. The city posts road signs that designate the group and the adopted section of stream. Not only has the advertisement been good for the groups, it's also been great for the Adopt-a-Stream program. Smith said most of the city's main creeks, such as Crabtree and Walnut, have been adopted, and now the program is concentrating on the smaller tributaries.

"Those little tributaries are equally important because if a contaminant gets in up above, we really won't know about it looking at the stream down below because it gets mixed in and diluted," Smith said.

Lost and Found

Asheville is another city that is quickly gaining new respect for its interior waterways. The French Broad River flows through the center of Asheville, which is an old industrial zone. Karen Cragnolin, executive director of RiverLink, a conservation group in Asheville, believes the French Broad's problems stemmed from development that blocked people's view and access to the river. For all intents and purposes, the river had disappeared within the city, becoming the dirty secret no one wanted to confront. Nutrients polluted it, and at one time the banks of the river were used as landfills.

"The river had become a place where the city wanted to put everything it didn't want to deal with," Cragnolin said.

However, that attitude began changing in the late 1980s and galvanized in 1998, when a drought left the city with a water supply that could be measured in days. "All of a sudden, people started realizing just how valuable all of our water systems are," she added.

RiverLink has worked to install the first greenway along the river in downtown Asheville and has recently purchased the old Asheville Motor Speedway, where another greenway will be put in. Also, a citizen water-monitoring program was initiated countywide, along with periodic trash-cleanup days. To change people's perception of the river, the group has created the French Broad River Yacht Club, a registered trademark. Club members have access to a canoe and kayak course. Club membership is free. Combined with the greenways, all of these efforts are aimed at getting Asheville's

***Exiting the** southern end of Mecklenburg County, Little Sugar sheds its metropolitan constraints for a life of relative freedom that ends, ultimately, at Lake Wateree.*

citizens more in touch with the French Broad, in hopes that they will take better care of it.

"At one time, you could drive by the river and couldn't see it," Cragnolin said. "Now, people can boat on the river, they can ride a bike beside it or have a picnic on it."

The rediscovery of our urbanized waterways is occurring throughout the state. Government agencies and concerned citizens are realizing that small nuisances in metropolitan tributaries become big problems downstream. Through restoration programs, some of these once-blighted segments are getting complete makeovers. Trash is being removed, man-made channels are being naturalized, parks are being constructed and water quality is improving. But more important, people are getting reacquainted with these hydrological transients. They are walking the streams, strolling the greenways, paddling the currents and—in the process—starting to care. ⊠

Harnessing rivers

Fontana Dam, 480 feet

DAMS

Dams stand as massive monuments to man's triumph over nature, bridling once free and wild rivers to do our bidding. But there's a price for flood control and cheap electricity—a toll on the environment that some are now saying is too high.

written by
Rodney Foushee

photographed
by Ken Taylor

■ The gathering near Goldsboro was unlikely at best. Environmentalists, fishermen, politicians, utility workers and the nation's top environmental official all joined together in eastern North Carolina for one history-making purpose—to release the Neuse River from the bounds of a low-slung concrete-and-steel dam—all in the name of fish. And in the process, the group would witness the nation's first removal of a major dam for environmental reasons.

The Quaker Neck Dam was never a great marvel of modern engineering. Built in 1952 to provide a constant water supply for Carolina Power & Light Co.'s Lee Steam Plant, the dam stood just 12 feet high. But it was tall enough to hold back the Neuse River for 45 years, and to block the spawning migrations of generations of striped bass and American shad from a thousand miles of water upstream in the process.

This would all be rectified during the events of this pleasant December day two years ago. And before the day's ceremony was complete, word of the events at Quaker Neck would help spur a dam-busting movement that has spread across the nation.

"We're removing a dam today in order to restore a river," secretary of the interior Bruce Babbitt told the enthusiastic crowd gathered near the base of the old dam. "By restoring a river and a fishery, we will recapture an important part of North Carolina's heritage."

Then Babbitt joined his counterpart at the state level, N.C. Department of Environment and Natural Resources secretary Wayne McDevitt, and the two men headed off toward the dam. Armed with sledgehammers, the secretaries alternated ceremonial licks on the structure. A wrecking ball attached to the shovel of a large backhoe continued the pummeling where the secretaries left off. The pounding of the wrecking ball at Quaker Neck posed a question that was once considered unthinkable: Could streams run free again? Could we remove the dams?

Engines of Progress

Dams—both small and large—have helped shape the settlement and define the growth of North Carolina since colonial days. Rivers might have been the state's first highways, but dams proved to be the engines of progress.

The first dams, constructed more than two centuries ago, harnessed the power of rivers, streams and creeks to grind corn into meal and wheat into flour. From the upper Coastal Plain to the Mountains, the location of a gristmill was often the center of civilization for a community.

By the mid 1800s, thousands of gristmills were in operation across North Carolina. Most Piedmont streams and rivers were dammed every few miles to provide waterpower for a mill. Though most of the mills themselves have long since vanished, hundreds of old millponds remain. The

GOLDSBORO NEWS-ARGUS

***Secretary** of the Interior Bruce Babbitt (below, left) and state environmental secretary Wayne McDevitt trade licks on the Quaker Neck Dam near Goldsboro. The removal of the dam on the Neuse River opened up 1,000 miles of streams to spawning striped bass.*

N.C. WILDLIFE RESOURCES COMMISSION

***Of the** nearly 5,000 dams in North Carolina, less than 200 are currently used for producing power or supplying drinking water. Many of the remainder function for agriculture and recreation, but holdovers from the past are common such as this abandoned dam on the Linville River near Crossnore, which was built in the 1920s to produce electricity.*

millponds and the countless worn millstones that can still be found decorating rural yards bear strong testament to the universal demand for flour.

But backing up small rivers and streams with stone-and-wooden structures to grind grain was only the beginning of dam building in North Carolina. It was the invention of electricity and the subsequent rise of the textile industry that spurred a flurry of dam construction in the state at the beginning of the 20th century. Hundreds of dams sprang up nearly overnight in the Piedmont to provide electric power for textile mills. And with the damming of rivers for hydropower came jobs and prosperity for North Carolinians.

"Clearly what attracted the textile industry to North Carolina was the fall line," explains Dave Moreau, a water resources planning professor at the University of North Carolina at Chapel Hill. The sharply sloping land above the fall line—the long geographic divide between the Coastal Plain and the Piedmont—provided an ideal location to dam rivers. "And this is where the state's population centers—Raleigh-Durham, Greensboro, Charlotte—are still located today," Moreau says.

Blessing or curse, many of the state's current urban and suburban areas can be tied to favorable geography and dams constructed decades ago.

Most of the state's largest dams were built in the first half of the century by private companies to provide electricity for industry and home use. Both the Catawba and Yadkin rivers were dammed up by 1925, with Duke Power and Alcoa respectively footing the bills. The federal government tried its hand at large-scale dam building in the 1940s and 1950s in North Carolina with the construction of the Tennessee Valley Authority lakes in the western corner of the state. These massive structures—Fontana Dam stands at 480 feet—were intended to bring power, flood control and jobs to the impoverished mountain region. The remaining large dams, creating Lake Norman, Falls Lake, Kerr and Jordan reservoirs, were completed between 1953 and 1983. All were multipurpose projects with goals ranging from power generation, flood control and water supply to providing recreational opportunities.

The era of big dam building is over in North Carolina, Moreau insists. "After nearly a century of reservoir construction, most of the good sites for dams have already been developed," he said. One notable exception, the Randleman Dam project in Randolph County, is finally under way after years of legal wrangling. Once the dam is complete, burgeoning Greensboro and High Point will have additional water to supply their expanding populations.

With the big dam-building boom over, we have amassed an impressive number of structures to back up our rivers and creeks: nearly 5,000 dams in all, in a myriad of shapes and sizes, scattered across North Carolina. And we continue to build dams—mostly small structures for golf courses, farm ponds, city parks and subdivisions—at the rate of about 50 new ones a year.

The Cost of Dams

Are there too many dams? One who thinks so is John Alderman, a biologist with the N.C. Wildlife Resources Commission.

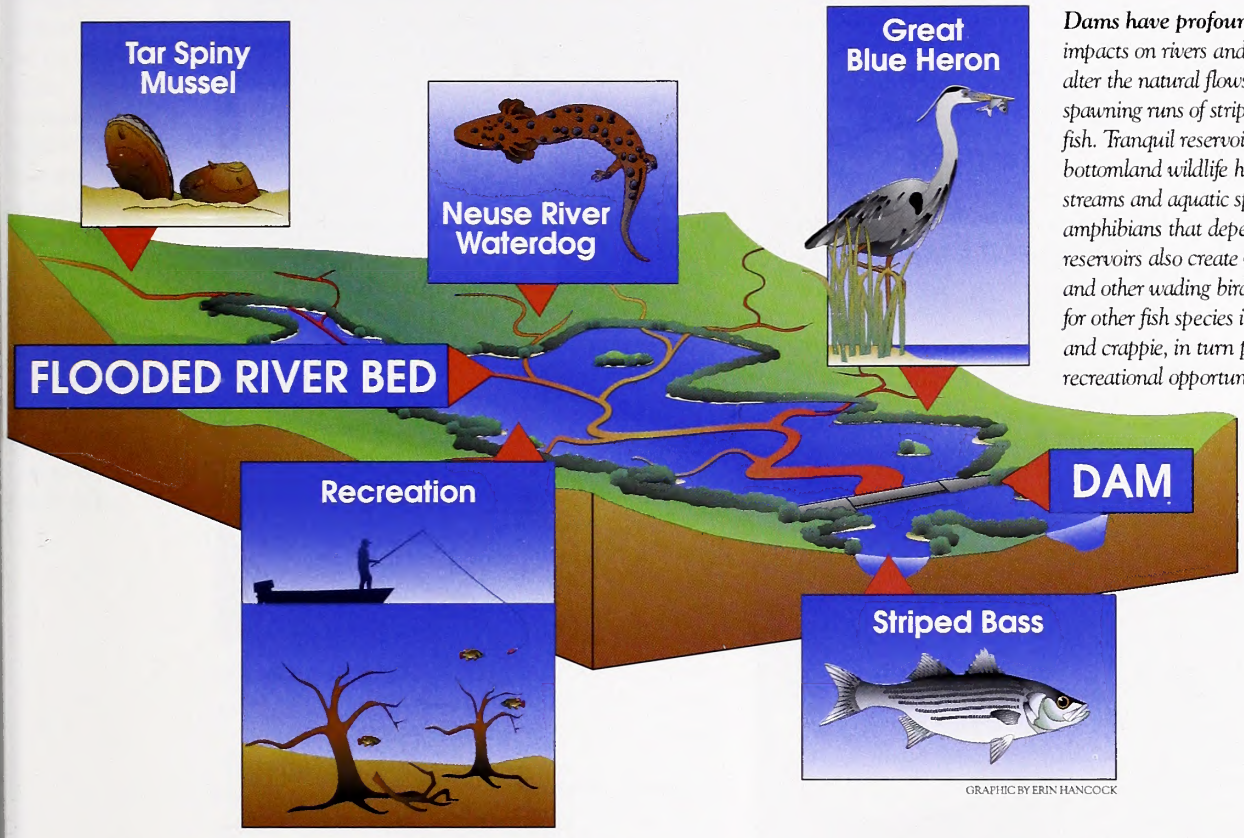
"When you look at most of the river basins of North Carolina, you find major dams and reservoirs," Alderman says. "Before you had these dams and reservoirs, the water flowed freely from the headwaters to the coastal sounds, and animals were able to move freely up and down. Once we put the dams in place, they acted as major barriers to the migrations and movements of these animals."

And it's not just anadromous fish species such as striped bass, American shad and sturgeon that are blocked by dams. Dams change the basic character of a river and its watershed many miles above

***Dams** change the basic character of a river, threatening once common species such as the Carolina madtom (below), which depend on clean, flowing water for survival.*

MELISSA McGAW

DAMS CHANGE RIVERS



GRAPHIC BY ERIN HANCOCK

***Dams have profound** negative and positive impacts on rivers and the environment. Dams alter the natural flows of rivers and block the spawning runs of striped bass and other migratory fish. Tranquil reservoir waters also cover rich bottomland wildlife habitat and isolate tributary streams and aquatic species including mussels and amphibians that depend on flowing water. But reservoirs also create wetland habitat for herons and other wading birds as well as aquatic habitat for other fish species including largemouth bass and crappie, in turn providing fishing and other recreational opportunities for humans.*

and below the structure. Upstream, the stilled waters of a lake cover rich bottomland habitat that once served as a home for wildlife and buffer for runoff. These same tranquil waters also isolate aquatic populations, such as freshwater mussels, native river fish species and amphibians, that depend on flowing water for survival, making them increasingly vulnerable to being wiped out by natural or man-made events.

"Essentially these populations are living on smaller and smaller islands of aquatic habitat," Alderman explains. One large reservoir, such as Falls Lake or Lake Norman, can isolate hundreds of smaller streams and rivers that once were connected. Sediments and nutrients that would normally be flushed away by swift currents accumulate in the lake itself.

Downstream, dams alter water flows, sediment loads, oxygen levels and water temperatures. They hold back floodwaters, considered destructive to human settlement but vital to many plant species that have evolved to take advantage of the rising and falling waters. The bottom line is that dams permanently change a watershed.

To Alderman, dams are some of the structures most destructive to the environment that we build in North Carolina. "The damage extends way beyond the dam and the habitat destroyed under the waters of the reservoir," he says. "The development that follows consumes the surrounding landscape."

It's this indirect impact of reservoir construction that is the death knell for the environment, Alderman argues. By providing additional water sources, reservoirs allow human population growth to continue unabated.

"We wouldn't have a Charlotte without Lake Norman or a Research Triangle without Falls and Jordan lakes," Alderman points out. "It's this additional source of water that fuels growth today." Water for new homes, lawns, commerce and industry.

A Matter of Water

Before we rush out and pull down all of the dams in North Carolina in the name of the environment, take a long look around you. Where does the electricity that lights the bulb you're reading by come from? Where does the water from your faucet come from? Chances are they're both connected to a dam.

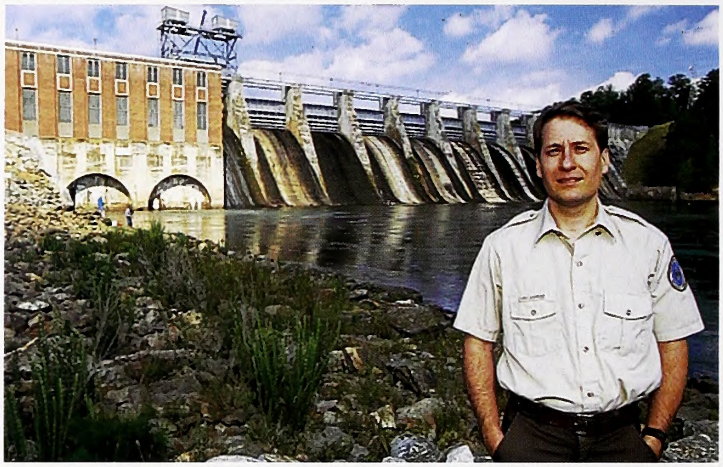
In fact, nearly all forms of electrical power generation—hydroelectric, coal-fired, even nuclear production—depend on an abundant, stable water supply. And more than 90 percent of North Carolina's largest population centers depend on reservoirs for drinking water.

Dams and dependable water supplies are integral parts of modern life, explains John Morris, director of the N.C. Division of Water Resources. "The big problem with rivers is that the natural flow is so variable between droughts and floods," he says. "The basic purpose of building dams is to even out these extreme swings by storing and releasing water at a more even flow."

And the number of people depending on backed-up rivers for drinking water and other purposes is climbing rapidly. "North Carolina is a fast-growing state; we've got the tenth largest population in the nation," Morris explains. "All of these people need water."

Morris stresses the trade-offs of dams. "There are tremendous positive benefits of dams," he says. "But like almost all things in society, there are also negatives. The issue is to get the right balance between these positive and negative influences."

He agrees that dams have the negative environmental impact of converting stream habitat into flat-water habitat. "We've lost a lot of bottomland wildlife habitat because it's been covered up by these large lakes. On the other hand, reservoirs provide habitat for many other species, including waterfowl and fish, as well as provide recreational opportunities."



Chris Goudreau, *with the N.C. Wildlife Commission, hopes to lessen the impact of dams on the environment during the next decade when most of the state's major power-producing dams come up for relicensing.*

Morris points out that although many dams are valuable, some dams have outlived their usefulness. In fact, the Division of Water Resources was the lead state agency that worked with CP&L to remove the dam at Quaker Neck. The agency also worked more recently to remove a smaller dam on the Little River, a tributary of the Neuse. "Not all of these dams are needed," Morris says. "What we need to do is look for dams that no longer meet the purpose they were intended for and those whose removal will provide the most environmental benefit." For fish that migrate from coastal waters to spawn in rivers, including striped bass and shad, that means removing downstream dams first.

The problem is, many dams built for one purpose now serve other equally important ones. Consider the three locks and dams on the Cape Fear River between Wilmington and Fayetteville. Built by the U.S. Army Corps of Engineers during the 1930s to allow barges to navigate the river more easily, the structures once supported a booming inland shipping trade. But today commercial traffic on the Cape Fear has virtually dried up—replaced by four-lane highways and transfer trucks. Lockmasters are now lucky if one commercial vessel passes through the locks in a month.

Though never intended for water supply protection when it was built some 60 years ago, the most downstream structure—Lock and Dam No. 1—is now critical to the water supply of the booming port city 20 miles downstream. The aged steel dam not only keeps the river artificially elevated for a nearly defunct inland shipping trade, it also prevents salt water from migrating upstream some 50 miles from the mouth of the Cape Fear and reaching the intake for Wilmington's drinking water supply.

Congress has yet to approve a feasibility study to officially look at removing the Cape Fear locks and dams, but the water supply protection issue shows how dams can outlive one use and take on another. And when it comes to a matter of water, even money isn't the top concern. Funding for the removal project could come from the Corps' own coffers. The agency recently revamped its policies to provide up to $5 million per project to fund stream restoration work, including removing dams. But if the locks and dams are breached, where's the drinking water for Wilmington going to come from?

Dam removal is not easy, says Morris, the state Water Resources director. But he is confident that more dams will be torn down for the environment in the future. "I'm sure we can find some more candidates for dam removal in the state," Morris says. "But a lot of dams are just too valuable to society now; it's hard to see how we can get along without them."

A Narrow Window

If we can't pull down the big dams in North Carolina, maybe we can work on making them more environmentally friendly, and taking out some of the thousands of smaller structures across the state that serve little or no purpose. That's the tack that habitat biologist Christopher Goudreau plans to take. Goudreau is the Wildlife Resources Commission's new dam relicensing coordinator. It's his job to work with North Carolina utility companies and federal regulators to lessen the impact of existing dams on the environment when their operating licenses come up for renewal.

Relicensing a dam to continue operating for another 30 to 50 years—the length of most federal dam permits—hardly sounds like a good way to help the environment. But as any good haggler knows, the best time to get what you want is during the bargaining phase. And with nearly all of North Carolina's major power-producing dams coming up for relicensing in the next 10 years, a narrow window is opening up to make a real difference for fish and wildlife for the coming century.

"The power companies have been given the privilege to use a public resource to generate power," Goudreau explains. "In return, they must give something back to the public." In the past, this has been through the construction of public boating access and recreation areas, fish stocking and other enhancement projects on power-producing lakes, but the environment often took a backseat.

Times have changed. "When many of these original licenses were issued in the '40s and '50s, fish and wildlife were not given the same priority as producing electricity," Goudreau says. "Most of

Though dams alter the natural flow of rivers, humans depend on them for a variety of needs including recreation. In western North Carolina, water released from a dam allows quality whitewater kayaking on the Nantahala River, while a dam on the Cape Fear River (below) concentrates American shad for steady fishing.

the country's major environmental laws weren't even on the books until the 1970s."

In 1986, The Federal Power Act, which authorizes the construction of dams and other structures for electricity production, was amended to give fish and wildlife equal consideration with power production.

The main objective of biologists is to lessen the impacts of dams. "In general, we want to adjust the power operations and their releases of water to more closely simulate the natural flow of the river," Goudreau says.

The adjustment of flow rates on the Roanoke River was critical to rebounding striped bass populations there during the past decade. Such success stories can be repeated on other Tar Heel rivers.

Besides flow rates, habitat improvement projects, including planting shoreline buffers, can be negotiated during dam relicensing. Finally, compensation for the loss of fish and wildlife from dams can be bargained for.

It is through "creative mitigation" that relicensing dams ironically holds promise for removing more dams in North Carolina. "For example, we could protect rare mussel species in a watershed that contains a large dam by removing smaller dams that are not being used and let the power company pay for it," Goudreau says.

More than 30 of the largest dam projects in the state—backing up the waters of the Yadkin, Catawba, Little Tennessee and Roanoke rivers —will be reviewed in the coming decade. "We don't have to pull down these big dams," Goudreau says. "There are plenty of small dams that can be removed to restore more natural river ecosystems in North Carolina."

Dare to Dream

Things are looking up for fisheries in the Neuse River two years after the removal of Quaker Neck Dam. Researchers from N.C. State University and the Wildlife Commission have been tracking spawning runs of striped bass and American shad on the river, and the results are promising so far.

And fishermen, including N.W. Poole, are once again catching spring stripers on the Neuse. The first spring after the removal of the dam he caught 20 stripers near Raleigh. This past spring was tougher, with low water, but that hasn't discouraged Poole from checking on fishing conditions nearly every day.

"I'm glad they removed the dam," says the 76-year-old retired Wake County well driller. "It sure has helped the fishing here."

There's no doubt that we can unplug more dams in North Carolina to help the environment—Quaker Neck has proven that. Will we pull down every dam in North Carolina for the sake of the environment? Unlikely. Are there dams that we can we live without? Absolutely. And in the process of pulling down some of these structures, we may just restore our rivers and our souls. ⊠

Friendly Persuasions

Want to know the secret to restoring a river? Just look at what is being done on the South Fork of the Mitchell River in Surry County. This tributary of the Yadkin-Pee Dee River Basin was in dire condition after years of neglect, but things have changed for the better since concerned citizens and nonprofit groups joined hands with state and federal agencies. The Mitchell's waters will be running clearer in the future as a result of their collaboration. Best of all, the story of the river's restoration is serving as a model for similar efforts elsewhere.

written by Rachel Wharton ©1999

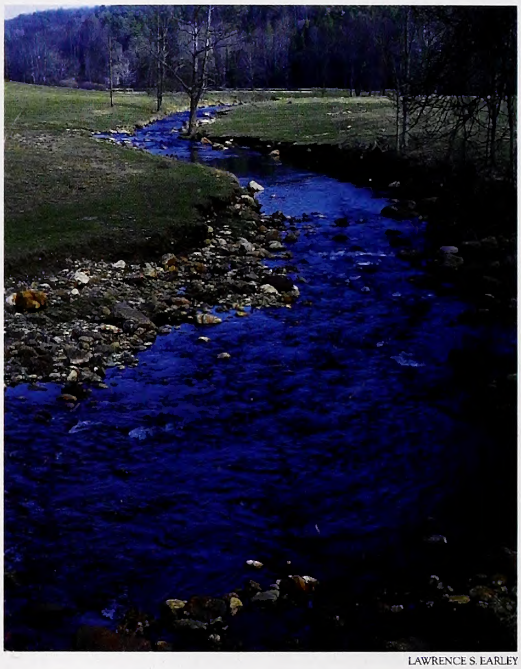
If you try to walk through the Lantern Restaurant with Dick Everhart during the lunch rush, you won't get very far very fast. The Lantern sits in the rural foothills of Dobson, between Elkin and Mount Airy. It's an old-fashioned place where everybody knows everybody. Everhart, a Natural Resources Conservation Service agent for Surry County, works next door to the Lantern and lives nearby along part of the Mitchell River. As he makes his way to his table, he's got to stop to talk to his neighbors, his co-workers, his wife's friends and his fishing buddies. And of course, he knows that it never hurts to network. Some of these folks might be potential volunteers for the Mitchell River Coalition, an alliance of concerned agencies, nonprofit groups and individuals.

For the past two years, Everhart has spearheaded the coalition's restoration project along the Mitchell River's South Fork. Due to logging, development and farming, the South Fork faces complications with pollution, silt and streambank erosion. The purpose of the coalition is to solve these problems. And like similar groups, they've discovered the solutions don't come from any single source. They come from a collaborative effort.

A Policy of Inclusion

One of the strongest advocates of collaboration in North Carolina is Peg Jones, president of Save Our Rivers Inc., which serves the western part of the state. Jones likes to call the concept "inclusion."

"Inclusion means communicating, a skill that is becoming appreciated again," Jones said. "Instead of turf battles...pooling of resources, manpower and funding can occur. Besides the work part getting done, a sense of trust and respect grows among those willing to work together."



LAWRENCE S. EARLEY

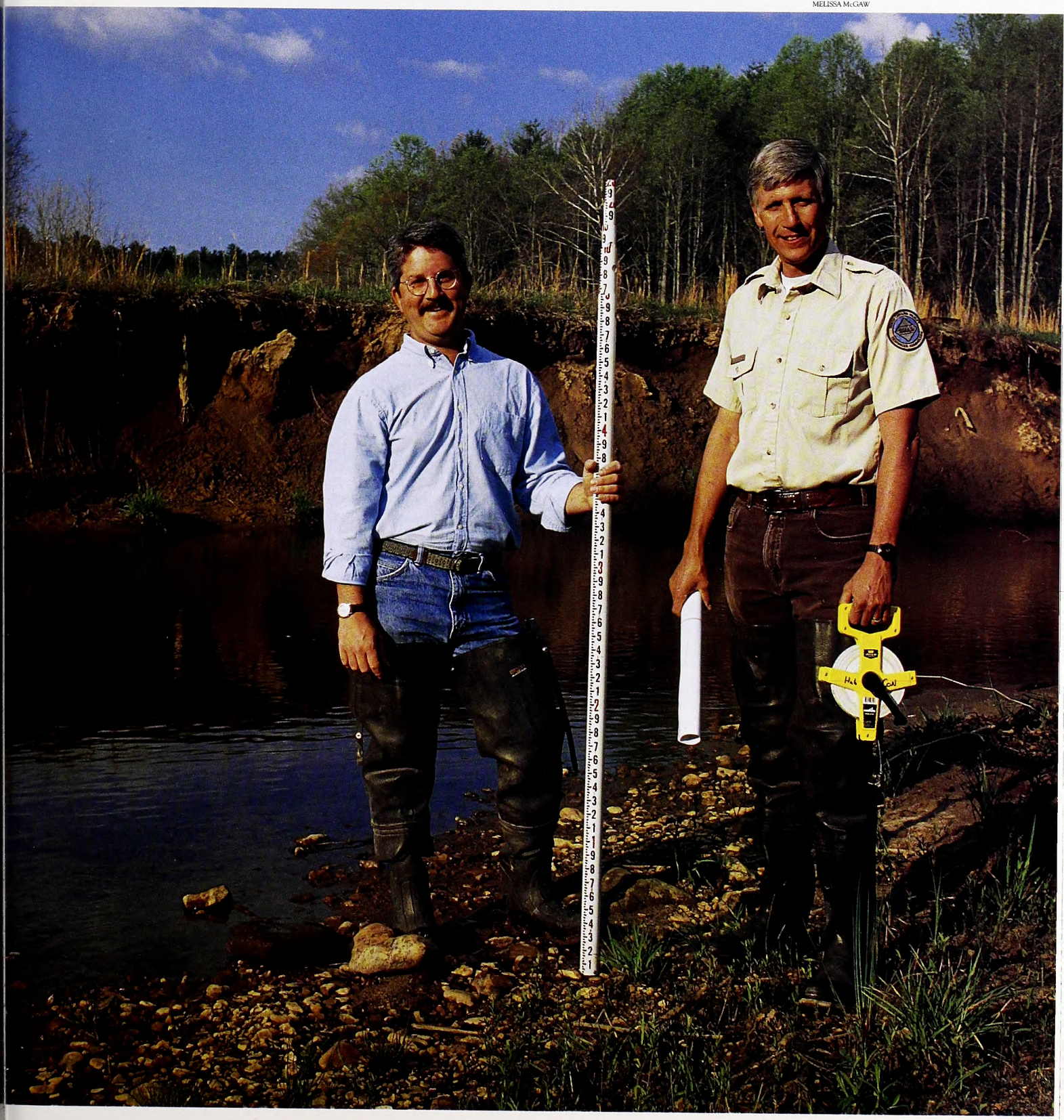
***Dick Everhart** (left), with the Natural Resources Conservation Service, and Joe Mickey, with the Wildlife Resources Commission, are working with a host of concerned groups and individuals to restore the South Fork of the Mitchell River in Surry County.*

At present, Jones is on the steering committee of the North Carolina Rivers Assessment, coordinated by the state's Department of Environment and Natural Resources. The goal of the group is to compile information on some of the state's 40,000 miles of rivers. State water-quality experts are ranking rivers according to a number of different categories, such as ecosystem status and economic benefit. In addition, citizen volunteers are being used to rate rivers' scenic and recreational qualities.

Once the assessments are complete, the NCRA will store the data in a geographical information system (GIS). The database, accessible through the Internet, could be used to display ratings for fisheries, wildlife and aquatic ecosystems. Or, the information could be used for ongoing assessments of river health and restoration projects like the one on the Mitchell.

Jones is also the executive director of the North Carolina Watershed Coalition, which is creating a network of information for each watershed. Another state program focused on sharing

MELISSA McGAW



MELISSA McGAW

Cattle grazing *along its banks are just one of the causes of erosion on the South Fork of the Mitchell River. On some stretches of the river, landowners are losing up to 10 feet of riverbank a year due to erosion.*

data across watersheds is the Basinwide Planning Program. North Carolina has 17 watersheds, and the N.C. Division of Water Quality prepares a management plan for each of them every five years. The plans include permitting schedules, point and nonpoint source pollution programs and regulations, trends as well as recommended strategies for improvement. Each basinwide plan also begins with a public meeting to gather input and recruit help.

"The state can make maps and sketch backgrounds of causes and sources, but we need local input and money for actual restoration," said Alan Clark, who heads the Basinwide Planning Program.

Even on a federal level, the concept of collaboration is gaining prominence. In 1998, President Clinton announced the Clean Water Action Plan, which focuses on restoring waterways by providing the resources and tools needed for collaborative partnerships. To carry out the initiative, the president's budget proposed $568 million in new resources in 1999 and a total increase of $2.3 billion over five years.

The Mitchell River Coalition is one example of successful inclusion, mainly because there is one dedicated person available to tie everyone together. To date, the coalition has enlisted volunteers to monitor the river, state agencies to collect river assessment data and help with planning, and landowners to implement better land management practices and donate parcels of their land for protection. In addition, the coalition has received grants for almost a million dollars.

The Problem

For several miles, the Mitchell River is divided into two parts: the Upper Mitchell and the South Fork. The Upper Mitchell is a model river—crystal clean and sparkling, edged on both sides by dense green woods. In fact, the Upper Mitchell is designated as an Outstanding Resource Water—one of North Carolina's highest water-quality classifications.

But the river loses this status where the Upper Mitchell meets the South Fork near the tiny town of Mountain Park.

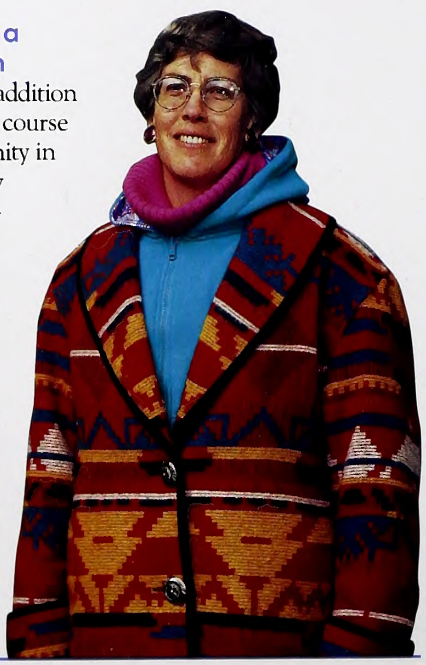
Unlike the thick, undeveloped forest surrounding the Upper Mitchell, the South Fork withstands a lot more use. Parts of it are used for logging, and this is only increasing as construction rockets across North Carolina. Some of the land is farmed or used for raising livestock. In many places, vegetation along the banks no longer exists. These riparian areas are important because they filter out pollutants and stabilize soil.

Parts of the South Fork have now lost their ability to move sediment successfully. Silt covers rocks that used to be visible from the surface and fills pools important to young trout. This also causes hydrological problems. These pools absorb the energy of the water as it rushes downstream. When the pools fill, the water's energy has no place to go. The water drives into the riverbanks, carving out banks at sharp angles. As a result, banks cave into the water, looking almost as if they'd been dynamited.

In some places, landowners are losing up to 10 feet of land a year, as opposed to an inch or so where the natural vegetation is intact. Sediment also inhibits electrical utility companies when they try to use the river's energy for electric power. And in many spots, the river's muddy waters are just plain unappealing.

Finding a Solution

The addition of a golf course community in the early 1980s—and the muddy water

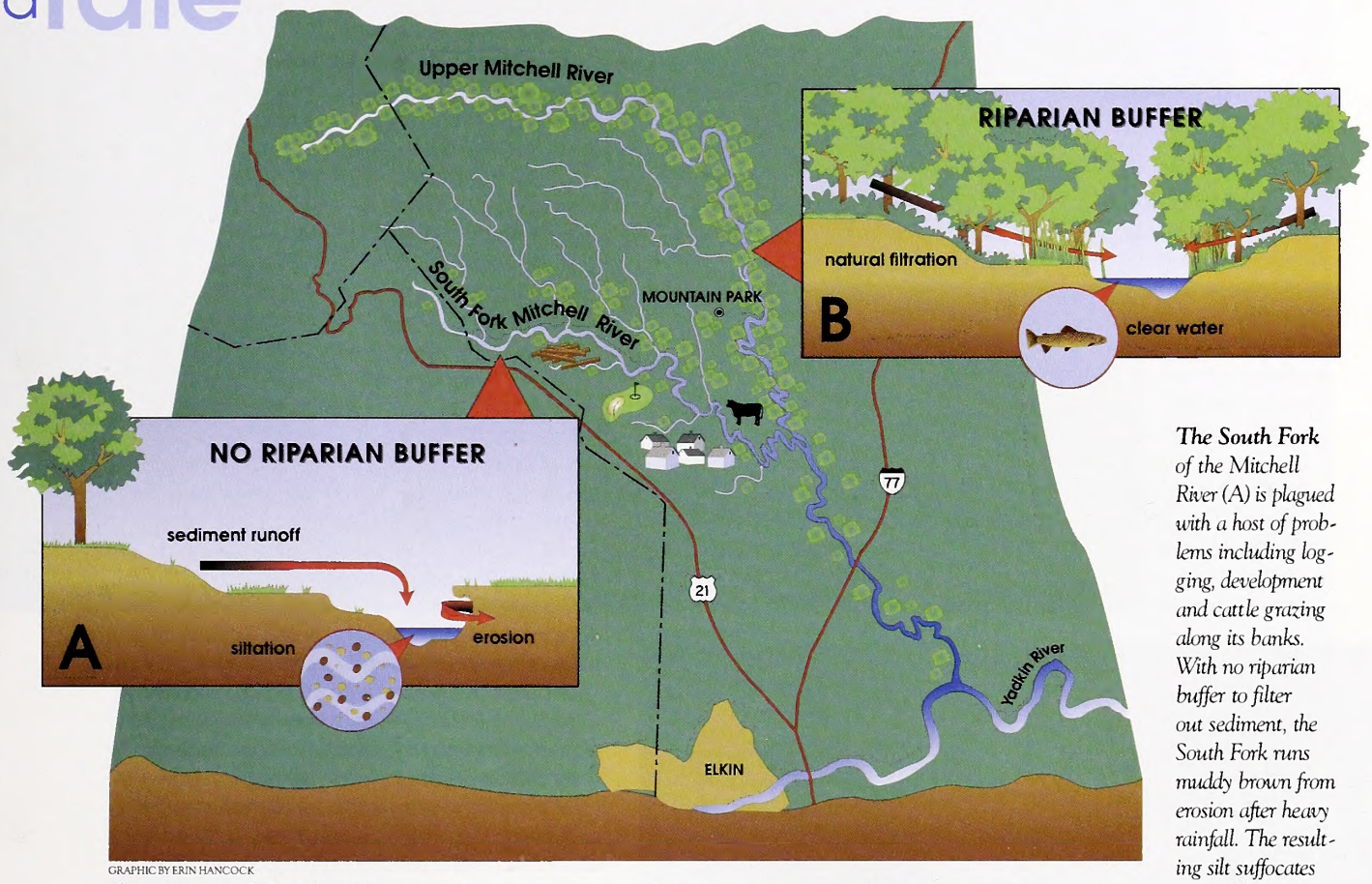


KEN TAYLOR

"Inclusion means communicating, a skill that is becoming appreciated again."

—Peg Jones

a Tale of Two Forks



GRAPHIC BY ERIN HANCOCK

The South Fork of the Mitchell River (A) is plagued with a host of problems including logging, development and cattle grazing along its banks. With no riparian buffer to filter out sediment, the South Fork runs muddy brown from erosion after heavy rainfall. The resulting silt suffocates much of the life in the stream. Just a few miles away, the waters of the Upper Mitchell (B) remain clear thanks to the buffering protection of thick, undeveloped forests along its banks. This naturally filtered water provides an ideal home for mountain trout and other aquatic wildlife.

that appeared during its construction—caused the public to really pay attention to the South Fork's problems.

"A lot of local citizens got real upset, and realized that the river they loved so much was being affected by development," said Everhart, "and they wanted to do something to protect it."

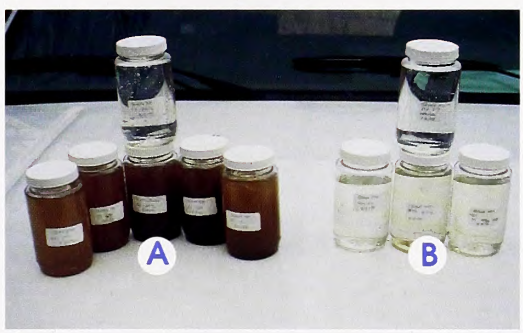
Like several other longtime locals, Everhart had always thought that the South Fork could be a better river. And, he said, the state's Division of Water Quality believes the South Fork could be improved with a restorative effort, maybe even to an Outstanding Resource Water.

So, he began to look for solutions.

Everhart first turned to PilotView Research and Development District. PilotView is the local chapter of a program funded by the Natural Resources Conservation Service to support rural environmental projects. There are eight such programs across North Carolina.

PilotView agreed to fund a meeting for interested parties in early 1997. That meeting resulted in the original project steering committee, and by September 1997, the coalition was created.

Through word of mouth and the growing prevalence of similar ideas, the coalition began to get more and more people interested in helping out the project. The North Carolina Cooperative Extension Service helped the coalition obtain a grant from the Environmental Protection Agency (EPA) of $9,000 for project design and management; $41,000 for education, monitoring, evaluation and technical assistance; and $40,000 for helping landowners better manage their land.



DICK EVERHART

The Piedmont Land Conservancy agreed to help and received a Clean Water Management Trust Fund grant for $880,000, earmarked just for the coalition. The fund was established by the state in 1996. At the end of each year, 6.5 percent of the unreserved credit balance in the state's General Fund, or a minimum of $30 million, goes to the trust fund, which can then provide grants to local governments, agencies or nonprofits to help finance water-pollution projects.

The Piedmont Land Conservancy is using this grant to help acquire properties, conduct water-quality monitoring, develop a long-term plan and develop a GIS system to prioritize Mitchell River sites for future protection or plans.

The coalition also received grants of $10,000

Restoring Our Rivers

The Mitchell River Coalition is only one of many river groups across the state that are striving to restore the integrity of rivers and streams. These important grassroots efforts are getting increasing help from a variety of programs—private and government—that are directing needed attention to river conservation and restoration.

American Heritage Rivers

In this 1997 program, President Bill Clinton gave special recognition to stretches of rivers that proved they had scenic, biological or historical value, as well as grass roots support. Communities could nominate their river to be an "American Heritage River." The New River in North Carolina received this award. Designated rivers will receive federal aid through programs, grants and technical assistance. The president is considering nominating other rivers in the future if the project is successful.

The Nature Conservancy's Freshwater Initiative

The Freshwater Initiative seeks to institute the concept of inclusion across the country. The program will provide a warehouse of information on the Internet, create demonstration sites for conservation or restoration and promote data collection for future projects. Most importantly, the Nature Conservancy will set up a center in Tennessee that will focus on the Southeast—which the organization calls "the most biologically rich and imperiled region in the world for freshwater species."

The North Carolina Conservation Trust

This is a statewide nonprofit that helps citizens and other land trusts protect lands that have natural value. The trust either purchases land or helps landowners with conservation easements, much like the Piedmont Land Conservancy working with the Mitchell River Coalition. The trust recently received a $420,000 grant from the Clean Water Management Trust Fund to create riparian protection plans for 20 sites. With help from other land trusts, the grant will help pinpoint sights that are valuable and work with landowners about restoration and easements.

Clean Water Management Trust Fund

Established in 1996, the fund consists of 6.5 percent of the unreserved money remaining in the state's General Fund at the end of each fiscal year. The fund's purpose is to help finance projects that specifically address water pollution problems and focus on upgrading surface waters, including drinking water supplies. The fund was also created to establish a network of riparian buffers and greenways for environmental, educational and recreational benefits.

Albemarle-Pamlico National Estuary Program

A result of federal, state and local participation, this program aims to protect and restore the estuaries in the Albemarle-Pamlico sounds region. To reduce pollution in these critical wetlands, the program seeks to integrate everything from citizen water-quality monitoring groups to wastewater discharge requirements to wetlands restoration.

from the Division of Water Resources, $20,000 from the U.S. Fish and Wildlife Service and other grants from the North Carolina Wetlands Restoration Program.

By 1999, with help from these funds, state agency staff, volunteers and others, the coalition goal has grown beyond restoring the South Fork to preserving and protecting the entire Mitchell River, with a watershed focus.

To date, the coalition's plans include monitoring, engineering projects, best management practices, land conservation and education.

Monitoring

Monitoring is a critical part of the Mitchell River restoration process. The data gathered will enable the coalition to pinpoint areas for future restoration. In addition, by comparing samples before and after the restoration projects are completed, the volunteers can determine if their restorative efforts were successful.

For example, Duke Energy is collecting sediment samples at 20 sites every other week over several years. This sampling will also help the corporation determine if similar projects would work in other parts of the state, where it has sediment problems.

As part of a statewide monitoring effort, the Division of Water Quality is conducting samples of aquatic insects, fish tissues and chemicals to determine long-term water quality. Each of these gives a different perspective on the water's ability to support life. The results are used to classify waters and assess restoration projects, and they are included in the state's basinwide plans and in the statewide GIS system.

The North Carolina Cooperative Extension Service is conducting bed-load monitoring. This determines how sediment is entering the river from a watershed perspective.

Each month, Streamwatch volunteers take temperature, dissolved oxygen and pH samples. Quarterly, they sample insects and water quality at monitoring stations set up along the river. Streamwatch is a statewide program managed through the Division of Water Quality to teach local volunteers to monitor the health of their river or stream.

Engineering Projects

The meat of the coalition's restoration project involves actively repairing streambanks degraded by erosion. In some cases, river sections are being moved to where their natural position would have been had erosion not occurred.

For these projects, the engineering plans are being provided by the Cooperative Extension Service. In addition, N.C. Wildlife Resources Commission habitat coordinator Joe Mickey, who reviews construction permits for the commission and lives along the upper Mitchell, is helping landowners design their projects to state permit specifications.

The coalition will also be rebuilding streambanks with natural resources such as root wads and plants and planting vegetation along riparian areas to stabilize the banks. In addition, the coalition has

MELISSA McGAW

***To restore** the South Fork of the Mitchell River, workers survey the stream's channel (left) and then slope and reseed it (below) after installing root wads to rebuild and stabilize the streambanks.*

a grant from the state's Wetlands Restoration Program to help restore a riparian bog by replanting vegetation and moving farmland. As logging in the area increases and suburbs grow around nearby Winston-Salem, riparian areas and wetlands are critical for protecting the river from future development in the watershed.

Best Management Practices

Best Management Practices (BMPs) help landowners and farmers use more environmentally friendly methods of development or farming. For example, Everhart helped several cattle farmers add stream-fed watering troughs to their land. This replaced the traditional method of letting the cattle wander through the water, destroying the banks and muddying the water.

Everhart also helps loggers put down grass seed over old logging trails once they've finished in an area. He is also helping farmers and landowners replant trees or vegetation along riparian areas.

In addition, the coalition helps farmers use federal and state cost-share programs that help pay to implement these BMPs, or it searches for additional funds, such as EPA grant money, for these efforts.

Land Conservation

Land conservancy is probably one of the most important aspects of the Mitchell River project. "Nobody protects the land—so that's where we fit in," says Nancy Treanor, executive director of the Piedmont Land Conservancy. "You can do all the federal restoration programs you want, but land conservation provides the assurance that nobody will clear-cut or build their house over it."

With help from the Clean Water Management Trust Fund grant, the conservancy has bought properties from participating landowners along the Mitchell River and its tributaries. In others

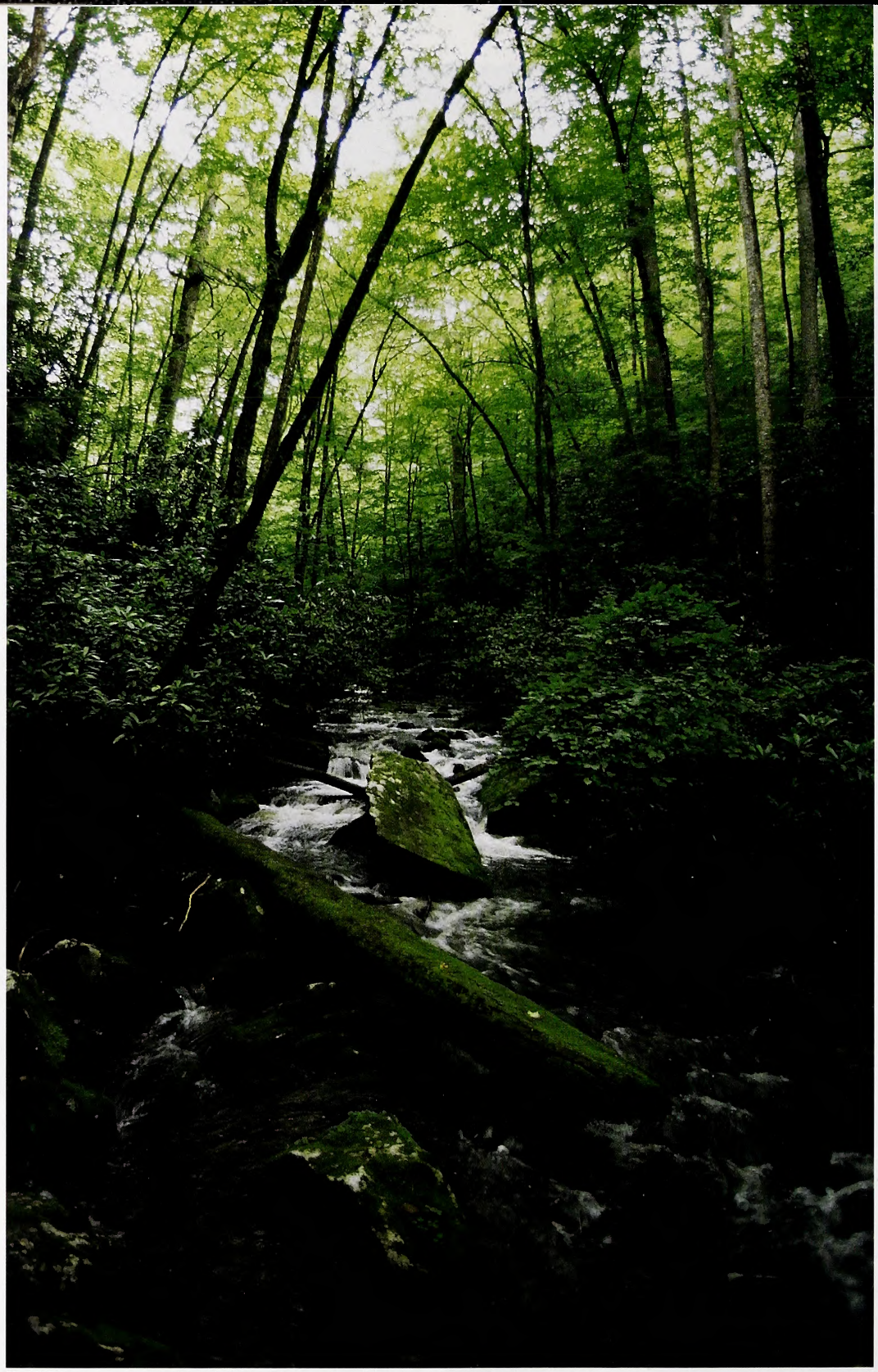
JOE MICKEY

cases, landowners are giving up part of their land in conservation easements. This means they still own the land but must sign a contract with the trust ensuring that they won't develop it. This provides the landowner with tax breaks and the coalition with the security that its work today won't be destroyed by a landowner in the future.

Education

The Piedmont Land Conservancy and the Cooperative Extension Service have helped create informational handouts for landowners about BMPs, wildlife habitat and donating land to conservation easements. They also publish an educational newsletter and plan tours, workshops and meetings.

For example, the coalition organized two field trips to Virginia to educate landowners about alternative watering methods for their livestock and sponsored a workshop to teach volunteers about monitoring and stream restoration.



With effort *and time, it may be possible to restore the Mitchell River to some of its former integrity. In a century, the river may take on the look of this pristine mountain stream.*

KEN TAYLOR

Putting It All Together

When Dick Everhart first started thinking about fixing up the South Fork of the Mitchell, he had planned to keep it small. But two years later, the Mitchell River Coalition has blossomed into a full-scale river organization. "Some weeks," said Everhart of the effort it requires from his office, "it's almost a full-time job."

But the effort is worth it. By working with everyone from the river community and sharing knowledge, the coalition now has a project plan that can serve as a model for similar organizations across the country.

"In the beginning, we looked at focusing on the South Fork—let's get a little bit of money and demonstrate some things that need to be done," said Everhart. "But folks heard and wanted the whole river." ⊠

written and compiled by Carla Burgess © 1999

THE EVERYTHING-YOU-WANTED-TO-KNOW-ABOUT-RIVERS

ALMANAC

A potpourri of interesting facts, figures, features, puzzles, events, people and critters associated with rivers.

Take It Outside!

Eastern Paddles

PART OF JOE MILLER'S JOB IS TELLING PEOPLE WHERE TO GO. In a nice way, of course. If it's outdoor adventure you want, particularly in the Piedmont or eastern North Carolina, Miller's weekly Raleigh *News & Observer* column "Take It Outside" has the ticket. What's more, his reviews of "natural" entertainment and local happenings, including loads of on-water opportunities, are all archived online.

Miller is partial to flatwater paddling and is always on the lookout for great day trips and weekend outings to share with readers. His number one prescription for stress relief is one of the lazy boat-floats down the Eno River known affectionately as "wafting." Choose one of the morning or afternoon slots for the ultimate decadence.

"It's such a great way to play hooky," says Miller. Because the small rubber kayaks are so easy to pilot, it's also a great introduction to paddling. Call (919) 471-3802.

Spring, summer and fall are the best seasons for paddling eastern rivers, he says. Many adventures, including "wafting," canoeing, backpacking and nature hikes, are cataloged at http://www.takeitoutside.com. Or pick up a paperback copy of Miller's second published volume of columns, *Take It Outside: Paddling*, at your local bookstore or by phone at (919) 836-2829. "Take It Outside" appears in the *News & Observer's* "What's Up" Friday insert and in Sunday's travel section.

Western Whitewater

IF YOUR TASTES TEND MORE TOWARD FROTHY STUFF, you can sample group rafting on western North Carolina's French Broad and Nantahala rivers spring through fall. Outings range from gentle float routes to class IV rapids. To find trips for beginners and experienced river-runners, in North Carolina and around the world, visit http://www.riversearch.com. The following companies offer raft trips in North Carolina and have toll-free numbers:

- French Broad Rafting Company (800) 570-RAFT
- Nantahala Outdoor Center (800) 232-7238
- Rafting in the Smokies (800) PRO-RAFT
- USA Raft (800) USA-RAFT
- Wildwater Ltd. (800) 451-9972

Stream Watchdogs

BELIEVE IT OR NOT, THE MOST POPULAR ACTIVITY AMONG Stream Watch volunteers is the bug inventory. You've got your midge larvae, your hellgrammites, your rat-tailed maggots—each with a story to tell about stream health. The amount and diversity of macroinvertebrates tell Adopt-a-Stream participants across the state about the vitality of neighborhood waters.

Of course, you don't have to touch insects.

"Squeamish people can use tweezers," said David Wojnowski, Stream Watch coordinator with the state's Division of Water Resources. More than 200 named Stream Watch groups across the state monitor waterways from humble feeder creeks to billowing rivers. A few groups have a modest calendar—maybe an annual trash pickup. The minimum requirement is one activity per year. Others plunge into the effort with test tubes and vials, hand lenses, kicknets and hip waders. They measure dissolved oxygen, check for turbidity and count critters, usually quarterly.

Starting a Stream Watch group doesn't require a lot of money—just time and energy. You don't even have to be a grownup—the youngest Stream Watch leader is 9 years old.

Influential environmental groups were once upstarts in this program. The Haw River Assembly is a notable "graduate" of the Stream Watch program. The organization now has 50 teams of river monitors in the Haw watershed, a month-long traveling festival, and a crew of seasoned volunteers.

But this doesn't mean that individual Stream Watch groups can't have significant impact. Volunteers who monitor regularly are in the best position to spot early warning signs of pollution. When that happens, the Division of Water Quality dispatches staff to confirm the analysis, Wojnowski says.

Call (919) 715-5433 to adopt your neighborhood stream.

Or visit the Stream Watch web site at:
http://www.dwr.ehnr.state.nc.us/wrps/swhome.htm.

Waterfront Living: Critter Style

AT THE END OF THE DAY, the tiny larva of the caddisfly *Hydropsyche* emerges from a tube-shaped underwater retreat to check its silken net. A "catch" of floating plant matter or tiny zooplankton is the reward for this creature's homespun efforts.

Like all caddisfly larvae, this critter has silk glands that distinguish it from other aquatic invertebrates. Hydropsyche is the only immature caddisfly that exploits the feature to trap food, but nearly all of the estimated 330 species native to the state's fresh waters use silk to bind bits of scavenged sticks, leaves or rock into remarkably diverse homes called cases.

The moral of "The Three Little Pigs" wasn't lost on juvenile caddisflies, which build shelters that withstand swift currents and even artistic scrutiny. Caddisfly larvae are best known to anglers as excellent trout bait. The swarms of hairy-winged adults are most familiar to casual observers. But stream ecologists recognize these critters as sentinels of water quality—most larvae are highly intolerant of pollution.

On a purely aesthetic level, the larval cases of caddisflies rival the beauty of shells found along the seashore. Caddisfly cases are less visible, usually found under and around submerged rocks, but the view through a magnifying lens reveals unparalleled craftsmanship. While a mollusk grows its protective shell, caddisfly cases are a feat of engineering.

Using their claws and legs—and a series of maneuvers worthy of a contortionist—caddisfly larvae construct cases in the shape of tubes, saddles or purses. The makeup of cases varies by species and also with the available materials. In one mountain stream, the creatures are known to use garnets they find as construction material.

"In the Little Tennessee River there are lots of garnets in the sand, and the cases we collect almost look faceted," said Dave Penrose, an environmental biologist with the N.C. Division of Water Quality.

Some caddisfly cases are affixed to rocks; others are portable. Either way, the cases function as ballast in often fast-flowing water. They also aid the creature in respiration by facilitating extraction of oxygen from the water. Portable cases provide shelter during food gathering. The net-spinning species attach their web-like traps to a fixed case.

Caddisflies are diverse animals—some are adapted to live in still or pooled water and a few can survive in polluted waters. It's the diversity, not the mere presence, of aquatic invertebrates like caddisflies that signals good water quality. Indeed, a surge in population of organisms, particularly net-spinners such as *Hydropsyche*, can be as much of a red flag as a massive die-off.

"If we're below a sewage treatment plant that's not working well, populations of these caddisfly species will explode because of food resources—we'll see hundreds of thousands of them," Penrose said.

Remarkably, *Hydropsyche* adapt the mesh size of nets to best accommodate the size of particulate food matter in a stream—whether it's large leaves in a small stream or fine sediments in a large river. The mesh diameter in rivers such as the Little Tennessee and French Broad are comparatively small, Penrose said.

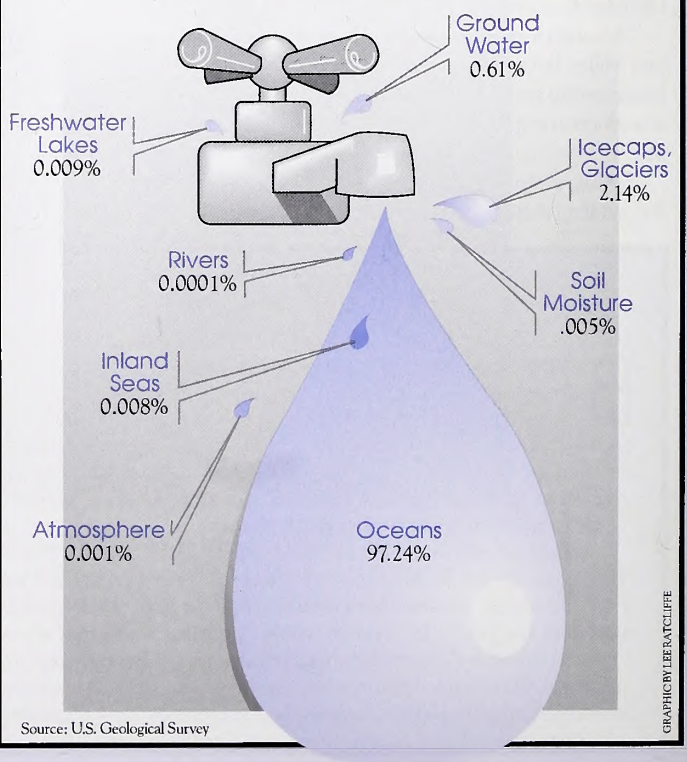
Lots of Caddisflies!

• There are 17 families of caddisflies in the order Trichoptera, which means "hairy-winged." About 7,000 species are known worldwide.

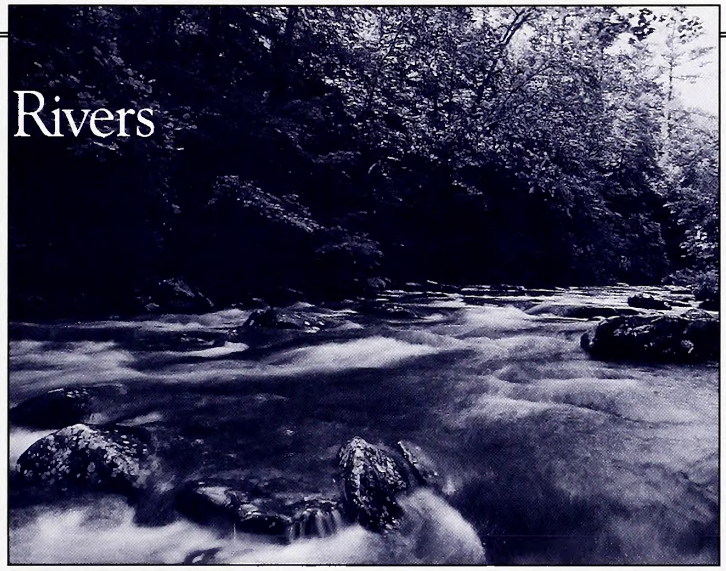
• The source of the common name caddisfly is unclear, although Norman Hickin surmised a connection to the term "cadice men" of Shakespeare's day. "My own explanation concerns the itenerant vendors of bits of stuff, braid and ribbons, who travelled the countryside calling at isolated cottages and hamlets," Hickin wrote in *Caddis Larvae*. "They pinned or stuck their wares on their coats as an advertisement for their business ... . Is it not very likely that the 'cadice-worm' in the streams and pools received its name from the cadice men who stuck all sorts of cloth and worsted braid (or caddis) on his coat?"

Where Does Water Come From?

Rivers contain only a tiny fraction of the earth's water, yet that's where most of the water we use comes from.



Celebrating Rivers



KEN TAYLOR

EACH YEAR, MANY RIVER organizations host celebrations and festivals. In 2000, designated by the N.C. Department of Environment and Natural Resources as the "Year of the Rivers," these events will be even more common. Some celebrations listed below do not yet have exact dates. Check with the contact listed before traveling to an event. For more festivals and events connected with "Year of the Rivers," contact the Office of Environmental Education, (919) 733-0711.

November

5-7 *3rd Annual Wings Over Water*, a celebration of wildlife and wildlands in eastern North Carolina that includes backwater swamp exploration on the Alligator River and a red wolf howling safari. Call the Dare County Tourist Bureau at (800) 446-6262 or visit online at http://www.northeastnc.com/wings.

13 *Deep River Park Turkey Regatta*, river fun, canoe rides and music, (919)898-4814.

20 *Annual Pamlico-Tar River Foundation Oyster Roast* fundraiser at the Washington Civic Center, 6 p.m. to midnight, features all-you-can-eat oysters, chili (meat and veggie), drinks, music and dancing, (252)946-7211.

April

Shad Festival, Grifton, (252) 524-4356. Call for dates.

Easter Monday Herring Festival, Jamesville, (252)792-5006. Call for dates.

Haw River Festival is a traveling, solar-powered environmental education extravaganza for children and communities in the Haw River Watershed, mid-April through early May at Brown Summit, Saxapahaw and Bynum, (919) 542-5790. Call for dates.

May

6 *Wooden Boat Show*, North Carolina Maritime Museum, Beaufort, (252)728-7317.

20 *Riverfest 2000*, a celebration of the Catawba River Greenway in Morganton, includes walks and canoe, bicycle and horseback rides, (828) 438-5351.

June

River Month, a regional celebration of the French Broad River, includes a riverfront triathlon in Asheville and month-long events. Call RiverLink at (828) 252-8474 for dates.

July

21st Annual Festival for the Eno, West Point on the Eno City Park, Durham, (919) 477-4549. Call for dates.

August

12-13 *30th Annual Sneads Ferry Shrimp Festival*, (910)327-4911.

The Moratock Triathlon in Danbury ends with a tube race down the Dan River. (336) 985-9622. Call for dates.

Ducky Derby Festival, Weldon, (252) 537-3513. Call for dates.

September

16 *North Carolina Big Sweep*, a statewide cleanup of rivers, streams and beaches, (919) 404-1600.

Elizabeth City Harbor Days, endemic "moth boat" races, Elizabeth City, (252) 335-1453 or (252) 335-2987. Call for dates.

October

Scuppernong River Festival, Columbia (252) 796-1371. Call for dates.

7 *Gates County Swamp Fest*, Gatesville, (252) 357-1440.

7-8 *River Fest Celebration*, annual riverfront celebration on the Cape Fear River in downtown Wilmington, (910)452-6862.

14 *Swansboro Mullet Festival*, Swansboro, (910) 326-1174.

21-22 *N.C. Oyster Festival*, Shallotte, (800) 426-6644.

New River Festival, Todd, (336) 246-4871. Call for dates.

For more information about events statewide, call the North Carolina Division of Tourism toll-free at (800)-VISIT-NC.

Riverkeeper® Program Makes a Difference!

North Carolina has four official Riverkeepers®.

- Rick Dove, Neuse River (252) 447-8999
- Donna Lisenby, Catawba River (803) 789-7007
- D. Bouton Baldridge, Cape Fear River (910) 762-5606
- Tom Mattison, New River (Onslow Co.) (910) 353-3352

To become a Riverkeeper® or receive more information about the Riverkeeper® Program, call Kevin Madonna, Executive Director, Water Keeper Alliance, (914) 422-4410

Free LAUNCH AVAILABLE

The N.C. Wildlife Resources Commission maintains 180 boating access areas across the state. For a complete listing, write:

Engineering Services Division, N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27604-1188

Also see http://www.state.nc.us/Wildlife/Topics/vessel.htm on the web.

CURTIS WOOTEN

River Crusader Offers Philosophy of Inclusion

Peg Jones got into the "river business" when she and her Franklin neighbors learned in 1990 that an upstream town had been given the go-ahead by the state to build a half-million gallon package treatment plant on the Cullasaja River. Angry at being left in the dark, Jones and friends formed Save Our Rivers Inc. and fought an unsuccessful legal battle to force the town of Highlands to conduct an environmental impact study. But the loss merely fueled their determination, and the group has since spawned strategic alliances and initiatives, notably the N.C. Watershed Coalition and the statewide Rivers Assessment Study. Once Jones enjoyed her privacy, but now she travels the state spreading the gospel of river conservation with the zeal of a missionary.

Why is river conservation your mission?

I know from experience what chemicals can do to people as well as to the environment. I want to help as much as I can so that we don't have losses of the environment, losses of wildlife and losses of the wonderful experiences that are associated with rivers—baptisms, swimming, picnicking, canoeing, or just sitting alongside the river watching it.

What do you think is the most immediate threat to rivers in North Carolina right now?

The lack of enforcement of our laws. We should care so much about our rivers that government officials will enforce the laws. That means when a plant wants to come in, you don't walk the permits through, you don't give favors to people. Every industry should be required to obey every rule that an individual would be required to. Industries should be required to have environmental impact studies and have public meetings so their neighbors can speak up.

What is the biggest accomplishment of Save Our Rivers?

I think it's our inclusion policy. We learned from experience what it's like to be left out of the process. Hog farmers? Bring 'em in. If you exclude people, you get hard feelings. I like to call everybody a stakeholder because everybody needs drinking water. Sometimes it doesn't always work. Sometimes you have to take a legal course, and that's a shame. But I think if you can somehow get to the table with your opponent, you have a chance at working things out.

Is there a big river success story statewide?

I think the main story would be citizen activism. I think we realize that's the way we've got to go now. We can't be isolated. We've got to work with partners. Environmental education is another key success story. Teachers are making a difference. Children nowadays know what headwaters are, they know what watersheds are, they know what silt is, they know that we've got to take care of the environment. People have been taught to care, and I really have to give a lot of credit to environmental educators.

River Reading

Rivers inspire a waterfall of words every year. Works by environmental writers can be poetic and politically important. A handful of local folks recommend their favorites—with nods to beauty, function and philosophy.

◆ *Pond Life, A Golden Guide*, by George K. Reid. This kid-friendly pocket manual is small but important, says Stream Watch coordinator David Wojnowski. "If everyone knew what is in this little book, the world would be a better place." For stream watchers, he suggests *Field Manual for Water Quality Monitoring* by Mark Mitchell and William Stapp. For a thought-provoking read, pick up *The Ecology of Commerce* by Paul Hawken.

◆ *The French Broad* by Wilma Dykeman is the pick of activist and former Stream Watch coordinator George Norris. "It's just historically accurate—all about the culture in that region and the river," he says.

◆ *Water: A Natural History* by Alice Outwater is "a fascinating book about how water quality has declined since the 1650s," says *News and Observer* outdoor writer Joe Miller. "She traces the decline all the way back to the beaver trade."

For more river-related books than you can shake a paddle at, visit American Rivers' online reading room at: http://www.amrivers.org/readroom.html . Also check out the titles at: http://www.people.virginia.edu/~djp2n/biblios/canoe.txt.

Museums and Interpretive Centers

The Roanoke/Cashie River Center on York St. in Windsor interprets the Roanoke River National Wildlife Refuge and the Cashie River area. Located just off N.C. 17 on the Cashie River in Windsor, the center includes a boardwalk that winds through marshes, wet meadows, swamps and forest. Free canoes are available for paddling. Open year-round, 8 a.m. to 5 p.m., summer 8 a.m. to 8 p.m. Free admission. (919) 794-2331.

The Scuppernong River Interpretive Boardwalk in Columbia gives visitors a view of the Scuppernong and its natural features. Open year-round, 24 hours a day, the boardwalk is handicap accessible. Free admission. (919) 796-1000.

The Cape Fear Museum interprets the history and culture of the region within a 50-mile radius of Wilmington. At 814 Market St., eight blocks from the Cape Fear River in downtown Wilmington, the museum is open 9 a.m. to 5 p.m., Tues.-Sat., and 2 p.m. to 5 p.m. Sun. Admission $4 adults, $3 senior citizens and college students, $1 ages 5 to 17 and free to children under 5. (910) 341-4350.

The Museum of the Albemarle at 1116 U.S. 17 South in Elizabeth City tells the story of the Albemarle region—from Native Americans to farmers to fishermen. Hours are 9 a.m. to 5 p.m., Tues.-Sat., and 2 p.m. to 5 p.m. Sun. Free admission. (252) 335-1453.

Albemarle Region Canoe Trails are located throughout a 10-county area. For a free map, write 412 W. Queen St., Edenton 27932, or call (919) 482-7437.

The North Carolina Estuarium sits on the Pamlico River at the intersection of Stewart Parkway and Water St. in Washington. Hours are 10 a.m. to 4 p.m., Tues.-Sat. Admission $3 adults, $2 K-12, free for pre-schoolers. (888) 737-0437 or visit: http://www.estuarium.com.

The North Carolina State Museum of Natural Sciences, in Raleigh, opens its new facility in April 2000, with a Mountains to the Sea gallery, including interpretation of wetlands, streams and rivers. (919) 733-7450.

The Pisgah Center for Wildlife Education, operated by the N.C. Wildlife Resources Commission, is located near Pisgah Forest in Transylvania County. Exhibits interpret mountain streams and other habitats. Open year-round, 8 a.m. to 5 p.m. (828) 877-4423.

Call the Office of Environmental Education for a complete list of environmental education centers in North Carolina. (919) 733-0711.

The River Quiz

1. What is the oldest river in North Carolina?
2. Where does the Yadkin River change its name to the PeeDee River?
3. What's the longest river in North Carolina?
4. What's the smallest river basin in North Carolina?
5. Which river basins are found totally within North Carolina?
6. What river basin flows north out of North Carolina?
7. Which river basins flow into Tennessee?
8. Which river basins flow into Georgia?
9. Which river basins flow into South Carolina?
10. Which river basins flow into North Carolina from Virginia?
11. What is the most impounded river in North Carolina?
12. What river basin is the most densely populated?
13. What river basin is the least densely populated?
14. What North Carolina river has the widest mouth?
15. Which rivers have been included in the federal Wild and Scenic Rivers System?

Answers:
1. The New River. Estimates of its age range from 3 million years to over 300 million years.
2. After it is joined by the Uwharrie River
3. Neuse River—248 miles
4. Savannah
5. Tar-Pamlico, Neuse, Cape Fear, White Oak
6. New River
7. Watauga, French Broad, Little Tennessee, Hiwassee
8. Savannah
9. Catawba, Broad, Yadkin-Pee Dee, Lumber, Waccamaw
10. Pasquotank, Chowan, Roanoke
11. Catawba—Lake James, Rhodhiss Lake, Lake Hickory, Lookout Shoals Lake, Lake Norman, Mountain Island Lake and Lake Wylie
12. Catawba—312 people per sq. mi.
13. Savannah—23 people per sq. mi.
14. The Neuse River
15. New, Horsepasture, Chattooga, Lumber

MELISSA McGAW

Volunteers—two-footed and four-footed—are always welcome at the N.C. Big Sweep each September.

Groups and Organizations

If you're interested in river issues and want to join an organization, chances are good it's just a local phone call away. The following groups, organizations and agencies focus on water-quality management, river preservation and access, environmental education, advocacy, recreation and research.

Statewide Groups

- *Citizens for Safe Drinking Water*, P.O. Box 18418, Asheville 28814, (828) 253-5383
- *Clean Water Fund of North Carolina*, Box 1008, Raleigh 27602-1008, (919) 832-7491
- *Conservation Council of North Carolina*, P.O. Box 12671, Raleigh 27605, (919) 832-8083, ccnc@bellsouth.net
- *Conservation Trust for North Carolina*, P.O. Box 33333, Raleigh 27636, (919) 828-4199 or (919) 828-5488
- *Division of Parks and Recreation, North Carolina Department of Environment and Natural Resources*, 1615 Mail Service Center, Raleigh 27699-1615, (919) 846-9991
- *Nature Conservancy*-North Carolina Field Office, 4011 University Drive, Suite 201, Durham 27707-2519, (919) 403-8558
- *North Carolina Big Sweep*, P.O. Box 126, Zebulon 27597, (919) 404-1600, ncbigsweep@mindspring.com, http://www.landmark-project.com/bigsweep/
- *North Carolina Coastal Federation*, 3609 Hwy. 24, Newport 28570, (252) 393-8185, (800) 232-6210, nccf@nccoast.org, http://www.nccoast.org
- *North Carolina Environmental Defense Fund*, 2500 Blue Ridge Road, Suite 330, Raleigh 27607-6454, (919) 881-2601
- *North Carolina Rivers Assessment Study*, N.C. Division of Water Resources, 1611 Mail Service Center, Raleigh 27699-1611, (919) 715-5424, steve_reed@mail.ehnr.state.nc.us, http://www.dwr.ehnr.state.nc.us/~rivers/index.html
- *North Carolina Soil and Water Conservation Commission*, 1614 Mail Service Center, Raleigh 27699-1614, (919) 733-2302
- *North Carolina Watershed Coalition*, P.O. Box 122, Franklin 28744, (704) 369-7877, rivers@dnet.net
- *North Carolina Wildlife Federation*, P.O. Box 10626, Raleigh 27605-0627, (919) 833-1923, tbean@igc.apc.org
- *North Carolina Wildlife Resources Commission*, 1712 Mail Service Center, Raleigh 27699-1712, (919) 733-3633
- *Partnership for the Sounds*, P.O. Box 55, Columbia 27925 or P.O. Box 340, Washington 27889, (888) 737-0437
- *Sierra Club-North Carolina Chapter*, 1024 Washington St., Raleigh 27605, (919) 833-8467, ncsierra@mindspring.com
- *Southern Environmental Law Center-North Carolina Office*, 137 E. Franklin St., Suite 404, Chapel Hill 27514-3628, (919) 967-1450, Derbc@selcnc.org
- *Stream Watch, Division of Water Resources*, 1611 Mail Service Center, Raleigh 27699-1611, (919) 715-5433, david_wojnowski@mail.enr.state.nc.us
- *Trout Unlimited-North Carolina Council*, 438 Armfield St., Statesville 28677-5702, (704) 873-3320

River Basin Groups

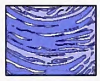
The following organizations focus on river monitoring and protection within particular river basins.

Broad River Basin

- *Foothills Conservancy of North Carolina*, P.O. Box 3023, Morganton 28655-3023, (828) 437-9930, foothillscnc@vistatech.net
- *Pacolet Area Conservancy*, P.O. Box 310, Columbus 28722, (828) 894-3018

Cape Fear River Basin

- *Cape Fear River Assembly*, P.O. Drawer 1089, Fayetteville 28302, (910) 223-4920
- *Cape Fear River Watch*, 617 Surry St., Wilmington 28401, (910) 762-5606, cfrw@wilmington.net
- *Haw River Assembly*, P.O. Box 187, Bynum 27228, (919) 542-5790, hra@emji.net
- *Northeast New Hanover Conservancy*, 126 Beach Road South, Wilmington 28411, (910) 686-0362
- *North Carolina Coastal Land Trust*, 720 Market St., Wilmington 28401, (910) 763-0332
- *Piedmont Land Conservancy*, P.O. Box 4025, Greensboro 27404, (336) 691-0088
- *Sandhills Area Land Trust*, P.O. Box 1032, Southern Pines 28288, (910) 695-4323
- *Smith Island Land Trust*, P.O. Box 3203, Bald Head Island 28461, (910) 457-4562



Catawba River Basin

- *Catawba Lands Conservancy*, 105 W. Morehead St., Charlotte 28202, (704) 342-3330
- *Lake James Environmental Association*, P.O. Box 430, Nebo 28761, (828) 584-0262

French Broad River Basin

- *Carolina Mountain Land Conservancy*, P.O. Box 2822, Hendersonville 28793, (828) 697-5777
- *Haywood Waterways Association Inc.*, P.O. Box 389, Waynesville 28786, (828) 456-2981, or (828) 456-5195
- *Pigeon River Action Group*, 121 Forest View Drive, Waynesville 28786
- *RiverLink*, P.O. Box 15488, Asheville 28813-0488, (828) 252-8474, http://www.main.nc.us/riverlink/
- *Southern Appalachian Highlands Conservancy*, 34 Wall St., Suite 802, Asheville 28801-2710, (828) 253-0095

Hiwassee River Basin

- *Hiawassee River Watershed Coalition Inc.*, P.O. Box 57, Hayesville, 28904, (706) 896-8091

Little Tennessee River Basin

- *Highlands Land Trust Inc.*, P.O. Box 1703, Highlands 28741, (828) 526-9938, Ext. 16
- *Little Tennessee Watershed Association*, Macon County Courthouse, 5 West Main St., Franklin 28734, (828) 369-6402, nbumppo@dnet.net
- *Save Our Rivers Inc.*, P.O. Box 122, Franklin 28744, (828) 369-7877, rivers@dnet.net
- *Upper Cullasaja Watershed Association*, P.O. Box 460, Highlands 28741, (828) 526-5266

Lumber River Basin

- *Lumber River Basin Committee*, P.O. Box 2185, Lumberton 28359, (910) 738-9396
- *Lumber River Conservancy*, P.O. Drawer 1087, Lumberton 28359, (910) 738-5257

Neuse River Basin

- *Eno River Association*, 4419 Guess Road, Durham 27712, (919) 620-9099; Festival (919) 477-4549
- *Neuse-White Oak Citizens Advisory Committee*, 7010 Thunder Mountain Road, Efland 27243-9772
- *Neuse River Foundation*, P.O. Box 15451, New Bern 28561, (252) 637-7972, nrf@cconnect.net, http://www.neuseriver.org
- *Triangle Land Conservancy*, 1100A Wake Forest Road, Raleigh 27604, (919) 833-3662

New River Basin

- *National Committee for the New River*, P.O. Box 1480, West Jefferson 28694, (336) 246-4871, ncnr@fastransit.net

Pasquotank River Basin

- *Albemarle Environmental Association*, P.O. Box 1706, Elizabeth City 27906, (252) 426-9563 or (252) 336-4778

Roanoke River Basin

- *Roanoke Canal Commission*, P.O. Box 38, Roanoke Rapids 27870
- *Roanoke River Basin Association*, P.O. Box 27, Gasburg, Va. 23857-0027
- *Dan River Canoe Trail Club*, P.O. Box 1375, Danville, Va. 24543
- *Roanoke River Partners*, P.O. Box 488, 102 N. York St., Windsor 27983, (252) 794-2793

Savannah River Basin

- *Friends of the Horsepasture*, P.O. Box 272, Cedar Mountain 28718, (828) 855-8229
- *Jocassee Watershed Coalition*, P.O. Box 272, Cedar Mountain 28718, (828) 885-8229

Tar-Pamlico River Basin

- *Edgecombe-Tar River Foundation*, P.O. Box 1594, Tarboro 27886, (252) 823-2220
- *Pamlico-Tar River Foundation*, P.O. Box 1854, Washington 27889, (252) 946-7211, ptrf@coastalnet.com, http://www.ptrf.org

Watauga River Basin

- *Friends of the Watauga River*, c/o Sierra Club-Blue Ridge, P.O.Box 587-DTS, Boone 28607
- *High Country Conservancy*, 577-5 George Wilson Road, Boone 28607, (828) 264-2511

White Oak River Basin

- *Friends of Newport River*, 946 Mill Creek, Newport 28570, (910) 223-3836
- *New River Foundation*, 179 Woodbrook Drive, Midway Park 28544, (910) 353-3352
- *Izaak Walton League-White Oak River Chapter*, 126 Sutton Drive, Cape Carteret 28584, (252) 393-7315

Yadkin-Pee Dee River Basin

- *Yadkin-Pee Dee Lakes Project*, P.O. Box 338, Badin 28809, (704) 422-3215
- *Yadkin River Commission*, P.O. Box 2511, Winston-Salem 27102, (336) 727-2087, glenns@ci.winston-salem.nc.us
- *Land Trust for Central North Carolina*, P.O. Box 4284, Salisbury 28145, (704) 647-0302

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PARTNERS

Wildlife in North Carolina gratefully acknowledges the financial support of its many partners listed below. Without their help, "The Rivers of North Carolina" would never have been possible.

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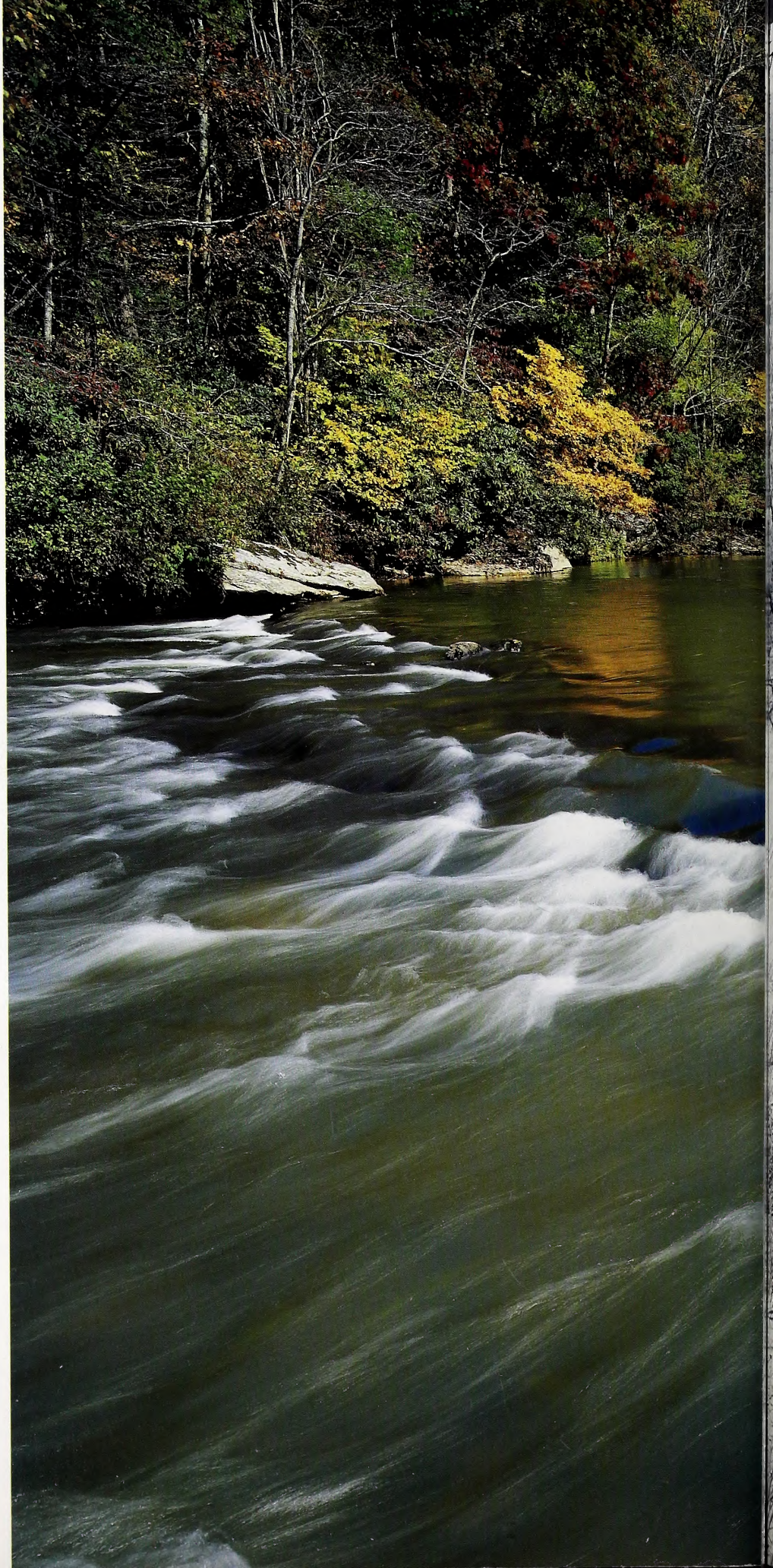

Voice of the Rivers

Autumn colors the hardwoods along the New River, one of the oldest waterways in the nation. The preservation of clean water and the conservation of our rivers and their myriad life forms are sacred duties entrusted to each generation.

Periodicals postage paid at
Hickory, North Carolina

LITHOGRAPHY BY THE HICKORY PRINTING GROUP,
CONOVER, NORTH CAROLINA

45
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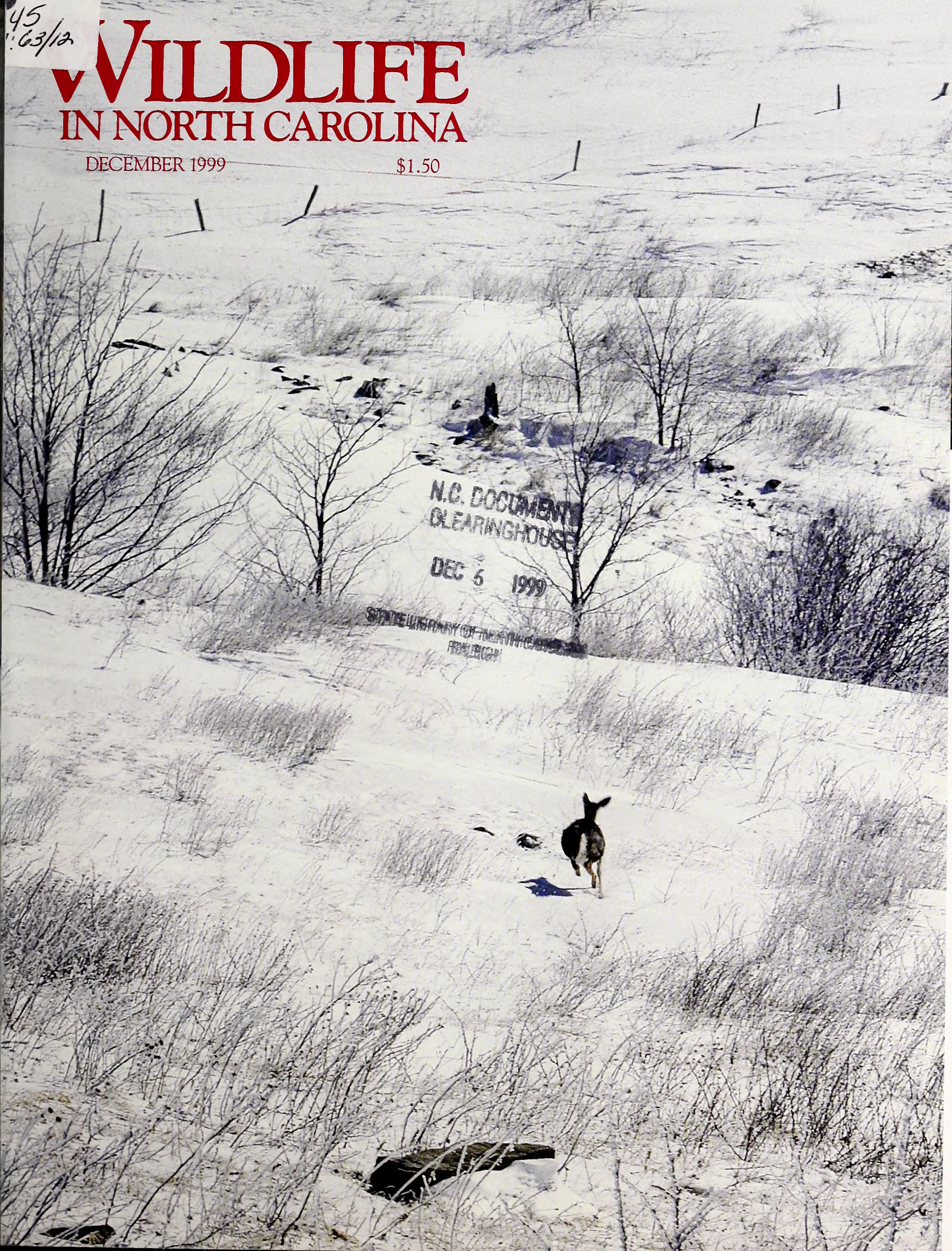
WILDLIFE IN NORTH CAROLINA

DECEMBER 1999 $1.50



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Reflecting on Foul Weather

by Jim Dean ©1999

JIM DEAN

"It takes bad weather to make memories, even if they're memories you'd just as soon forget."

Do you recall that truly lovely day back a few years ago when we followed your bird dogs through the brown fields under that wintry blue sky streaked with high, wispy horsetails and jet trails? I don't believe the dogs found any birds, but I think you remarked that you had never seen such splendid weather, even if it was a bit warm for hunting. Can't pinpoint it? Of course you can't. Me either, to tell the truth. Lacking some extraordinary event—like bagging three birds with a single shot or falling through a tangle of honeysuckle into a well—days afield in fine weather tend to get mixed up with dozens more not remarkably unlike them. It takes bad weather to make memories, even if they're memories you'd just as soon forget.

There are surely exceptions to this adage, I suppose, but not many. I've enjoyed some wonderful fly fishing on brilliant, crisp October days the past 40 years, yet I can no longer distinguish one from another. Likewise, I can't pick out very many specific days when I have surf fished, caught bass or hunted doves, ducks or anything else when the weather was perfect. But I can instantly identify those outings marked by a menace. Small wonder that the cliché grabber for any tale is "It was a dark and stormy night."

Last December, my brother John and son, Scott, and I hunted one of Mattamuskeet's blinds in a howling gale with gusts reaching 50 mph and a horizontal rain that felt like a load of No. 8 shot every time we stuck our heads up to see whether a duck had been blown into range. That day isn't going to blend into our four decades of annual Christmas hunts in Hyde County. Nor will the day we foolishly crossed Core Sound to get to our blind on the banks before dawn in a small boat, pounding through 4-foot seas into such heavy rain that we couldn't see the bow. Or that Christmas in 1981 when we broke ice all the way across Currituck Sound in a 17-foot juniper skiff and shot at ducks that were riding a 35-knot breeze. Big sheets of ice literally sawed off net stakes in front of the blind, and herded our decoys into the marsh. Or that 10-degree day when my brother Graham accidentally stepped off the side of the blind into 2 feet of icy water and nearly froze to death before he could get back to the car and get the heater going. We found him buck naked inside, pasted against the vents, with a bad attitude. Compared to those hunts, all our countless bluebird hunting days are mere blurs.

The most memorable day I ever had surf fishing occurred one November weekend when a bunch of us—the Cane Pole, Bluegrass, Steam Whisky and Ace High Straight Appreciation Society (CPBSWAHSAS)—gathered at Emerald Isle in hopes of catching a few trout and blues. We were on the beach in shorts and T-shirts enjoying the 75-degree weather when we spotted the roll cloud to our west, an ugly bolt of wind-driven flannel extending from horizon to horizon rushing towards us. The front came through so quickly we barely had time to take shelter in the dunes. The temperature plunged into the lower 40s within minutes. Did we catch any fish that trip? Nobody seems to recall.

Once, many years ago, I fished an ocean pier just hours before the arrival of a minimal hurricane—traffic leaving the island was backed up for miles and the blues were biting, so what else could I do? Thoroughly soaked by the rain and spindrift, and barely able to stand on the galloping planks with huge rollers pounding the pilings, I cast downwind and landed a cooler of nice blues. By then the roads were clear.

I have very fond memories of fly fishing for trout with my old buddy A.J. Johnson in the tail-end of an 8-inch snowstorm, and somewhat less fond memories of trying to outrun a massive thunderstorm on Lake Okeechobee in a 200-horsepower Ranger that seemed awfully slow although I believe the hull was occasionally in touch with the tips of the waves at 80 mph.

What brought all this to mind was Hurricane Dennis who squatted off Hatteras and waited until Charlie and Midge Ogletree and I figured it might be safe to go sailing on Albemarle Sound. Of course, we canceled our plans and I spent the weekend reading one of Patrick O'Brian's wonderful historical sea adventures set in the early 1800s.

And you know what I discovered that weekend? Bad weather removes guilt. You can hole up with a book, take naps, do nothing whatsoever remotely useful with an absolutely clear conscience. Well, at least that's what I thought until Floyd came along.

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Wildlife in North Carolina

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

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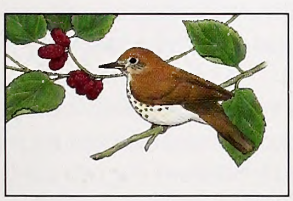
Departments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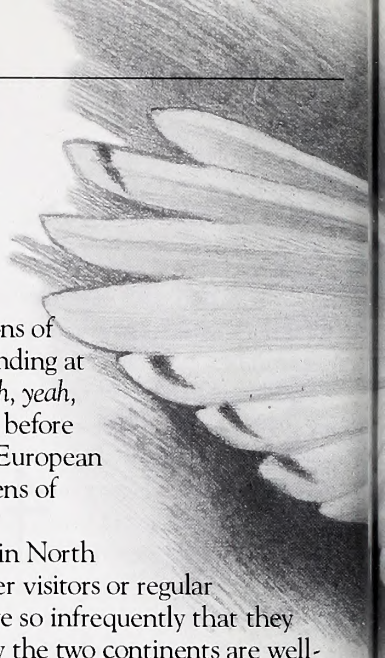
Cover *A snow-covered field plus a white-tailed deer makes a fine subject for a nature photographer. Photograph by Ken Taylor.*

Wildlife in North Carolina (ISSN 0043-549X) is published monthly by the North Carolina Wildlife Resources Commission, 512 N. Salisbury Street, Raleigh, N.C. 27604-1188. Periodicals postage paid at Raleigh, N. C. and other offices. Subscription rates: one year $7.50, three years $20, Lifetime $100. For subscriptions from foreign countries, payment **only** by U.S. Postal Service money order or cashier's check drawn on a U.S. bank. All orders must be prepaid. Please allow 6 to 8 weeks for new subscriptions or change of address. POSTMASTER: Send address changes to Circulation Manager, *Wildlife in North Carolina*, 512 N. Salisbury St., Raleigh, N.C. 27604-1188. Address all correspondence regarding subscriptions to Circulation Manager. If you have a problem with your subscription, call 919-662-4377. Articles in *Wildlife in North Carolina* may represent the personal views of authors, and do not imply endorsement by the N.C. Wildlife Resources Commission. *Wildlife in North Carolina* is available on cassette tape as a courtesy of volunteer services of the Department of Cultural Resources, Library for the Blind and Physically Handicapped, Raleigh, N.C., 919-733-4376. **The N.C. Wildlife Resources Commission is an equal opportunity agency.**

A Tale of Two Continents

written by David S. Lee ©1999
illustrated by David Williams



Depending on one's perspective, we tend to think of the European invasion of North America as the early explorations of the Spanish, the attempted colonization of Roanoke Island, the landing at Plymouth Rock, the War of 1812 or perhaps even the Beatles. *Yeah, yeah, yeah!* But the European colonization of the New World came long before recorded historical events. For example, numerous bird species of European origin colonized the New World during and before the Ice Ages, tens of thousands of years ago.

A large number of these European invaders still live right here in North Carolina, nesting within the borders of our state. Others are winter visitors or regular seasonal migrants, while a few of them are encountered in the state so infrequently that they are regarded as rare vagrants. A fair number of the birds shared by the two continents are well-known species such as oystercatchers, peregrine falcons, ravens, barn swallows and black-capped chickadees. In truth, it is unclear if many of them first invaded North America from Europe or vice versa.

The movements of large numbers of plants and animals occurring both in eastern United States and in eastern Asia were aided by a land bridge that crossed the Bering Sea during the late Pleistocene. Yet most of the shared European fauna are species that can fly, swim or float. Several zoogeographers have proposed a similar land bridge across Greenland between northwest Europe and northeastern Canada. There is little evidence for this. For example, there are only four land mammals that North Carolina shares with Europe and they probably got to eastern North America via the longer north Pacific land bridge route.

Not surprisingly many of the shared birds are seabirds. At least 35 shared western European species occur commonly in North Carolina's coastal and offshore waters. Most are primarily passage migrants (jaegers, Manx shearwaters) or winter visitors (gannets and kittiwakes and other gulls). Several species regularly nest along the North Carolina coast (least, common and Sandwich terns, for example). Not only are these marine birds strong flyers, but because both continents share the North Atlantic rim it is not surprising that a number of seabirds occur in both places. Other strong-flying birds also made the crossing. Fourteen species of waterfowl naturally occur on both sides of the Atlantic, as do at least 10 shore bird species and three types of herons and egrets.

The ranges of some of these birds are quite vast. Some raptors (goshawks, golden eagles, rough-legged hawks and short-eared owls) are found across much of the Northern Hemisphere; others have populated nearly the entire globe (barn owls, peregrine falcons and ospreys). The common moorhen, a species breeding in the southeastern marshes of our state, nests even on remote Pacific islands. Moorhens are not strong flyers and avoid marine environments, so they are unlikely candidates for such a wide distribution.

A number of North Carolina songbirds also occur in Europe. Although some are only winter visitors, several are well-known breeding species such as red-breasted nuthatches, winter wrens and brown creepers.

A rough tally shows a minimum of 90 species of North Carolina birds shared with eastern Europe. This represents just a little more than 20 percent of our total avifauna. Except for a few of the migrant seabirds, individuals do not regularly fly back and forth between the two continents. Distinct populations now inhabit each side of the Atlantic. In most cases genetic flow between the two global regions is reduced to the point that the birds have evolved into distinct races, with the individuals found here in North Carolina having slight but consistent variations in song, size or plumage from their European cousins.

A few are now recognized by ornithologists as separate species, but their appearances are so similar it is clear that, despite being regarded as full species, the direct relationship is obvious. Nevertheless, we tend to think of all these species as our birds. They are in our bird books, at our bird feeders and are checked off on our life lists. Yet, like many birds they are perhaps best thought of as world citizens—ones that racked up the first of the frequent-flyer miles.

Other Reading

- Birch, L. C. Birch (Ed.), *The Ecological Web : More on the Distribution and Abundance of Animals* (Andrewartha, 1986).
- Lambert, David, *Children's Animal Atlas : How Animals Have Evolved, Where They Live Today, Why So Many Are in Danger* (Millbrook Press, 1992).

Surfing the Web

- For information about the Pleistocene land bridge crossing the Bering Sea, see the web site for the Bering Land Bridge National Preserve (www.nps.gov/bela/html/history.htm), an article on the subject from the magazine *Cyberwest* (www.cyberwest.com/v9scwst1.html), and references to other sites and reading (earthsky.worldofscience.com/1996/esmi960110.html)

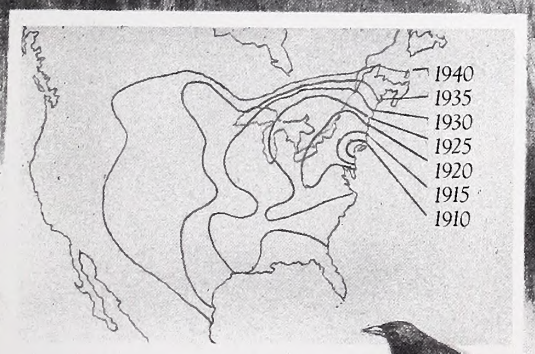
peregrine falcon

Snowy owls and peregrine falcons *are widely distributed across North America and Eurasia. The snowy owl is a northern species confined to tundra habitats and its distribution is best described as circumpolar. The peregrine is much more wide ranging and migratory. These falcons nest as far south as Mexico and also nest in Africa, Arabia, India, Ceylon, Australia and on various Pacific islands.*

snowy owl

The winter wrens *that breed in the mountains of North Carolina are the same birds that reside in Eurasia. In the Southeast, nesting winter wrens are confined to the higher elevations where the conditions are cooler.*

winter wren



redpoll

gannet

The starling is not *native to North America. The birds were released in New York in 1890 and their subsequent invasion of North America was rapid. Today they occur across the continent. They show how quickly a species can naturalize and spread.*

The BIG Rewards of small waters

The wide waters of coastals sounds may be too distant for many inland duck hunters, but streams and ponds can be fertile hunting grounds if you keep these tactics in mind.

written by Gerald A. Almy ©1999
photographed by F. Eugene Hester ©1999

To many people, duck hunting seems like an exclusive sport off limits to those who don't own broad reaches of tidal marsh or belong to tightly controlled waterfowl hunting clubs. But the fact is, ducks are available to anyone who wants to buy a hunting license and waterfowl stamp and try some less traditional ways to go after these migratory birds. And with duck numbers for many species near all-time highs, there couldn't be a better time to seek out this strong-flying quarry.

No, I'll never forgo an invitation to hunt with a time-honored duck club, and I'll continue to shell out the money for a classic guided trip on Currituck or along the Outer Banks, occasionally. But for a quick duck hunt close to home with little expense or equipment required, there are a number of good options I often turn to instead. And best of all, they're readily available to any North Carolina hunter.

The tactics I've used successfully include jump shooting, stalking the bank and setting out decoys on ponds, as well as floating and using decoys on rivers and streams. Not all bodies of water in North Carolina hold waterfowl in the fall, of course. But a good number do, and with a bit of preseason scouting, you can usually find several spots to try within a two-hour drive of your home.

Rivers and Streams

From the tiny tumbling creeks of the mountains to the sluggish, tannin-stained rivers of the east, these waters support thriving populations of ducks that range in species from diminutive blue-winged teal to big, majestic black ducks. While some rivers' tidal portions may be controlled by duck clubs, the stretches above the fall line offer a variety of great hunting.

Rivers and streams can be good for ducks from the first seasons in October right through the close of hunting in late January. Early on, you'll find many wood ducks. Later, a variety of species can be encountered, with mallards most common. If it gets cold enough in late December and early January for ponds and some lakes to freeze over, birds will flock to open-flowing waters in even greater numbers.

I use several techniques for river and stream ducks, but one of the most aesthetically appealing is float hunting. This can be productive on both large and small waters. On broader flowages, you should concentrate on one side of the river, either the inside bend on turns or the side with the most logjams, points or overhanging brush that ducks can hide behind. On small streams, it's usually possible to float down the middle of the creek and shoot at ducks that flush from either side.

Both johnboats and canoes can be used for float hunting. Johnboats are a bit more stable, but if you are familiar with canoes,

KEN TAYLOR

***A hunter uses a** sneak boat to blend in with a riverbank while duck hunting. Canoes as well as johnboats can effectively be used to pursue waterfowl on small waters.*

***Decoys are an** essential part of waterfowling, but duck hunters don't always have to use large spreads of 100 or more. A few decoys placed in a beaver pond or flooded swamp can provide decent shooting.*

they can certainly be used and are easier to maneuver through narrow openings between rocks and logs and in riffles. (Large, difficult rapids should be portaged.) Always wear a flotation device, since a dunking in winter can be dangerous. For emergencies, bring a waterproof boat sack with a change of clothes, butane lighter or waterproof matches and space blanket.

Boats should be camouflaged with flat-finish spray paints or at least painted a drab olive color. I sometimes tie a bit of brush on the bow to add further cover. The hunter in the rear should always keep his gun pointed toward the back, away from the bow man, and he should shoot only at ducks that flare back upstream. His main job is to control the craft and slowly scull his partner into range. Switch positions a few times during the float, so that each person gets a fair share of shooting.

For a half-day float, usually 4 to 8 miles is a good length. For a full-day outing, 6 to 10 miles is feasible. But take a short drift, rather than a long one. It's no fun being out in the dark or paddling frantically to reach a boat landing during fall or winter.

Stalking along the bank is the second approach I use for rivers and streams. This requires that you use public land or obtain permission from the landowners to hunt on their property. I particularly like this tactic for small- and medium-size flowages, where any duck that flushes will probably be in good shooting range. Small streams also tend to have lots of brush and trees along the banks, plus bends and elevated banks. All of these qualities help you sneak up for close shots. This tactic is also a good one to use if the weather has been dry and boats would tend to scrape bottom, flushing birds out of range.

The method can also be employed in

***By floating rivers** in low-profile boats (below), duck hunters can simulate a log or tree and come close to wary ducks before they flush (left).*

hunker down next to a logjam on the bank. The best time for decoying birds is in the morning, when the ducks are flying to and from feeding areas. Eddies, points, edges of islands, sloughs and riffles are all good places to set up decoys. Six to 12 decoys are sufficient, and if you have to settle on one species, mallard decoys are hard to top for bringing in all common types of river ducks.

Once, I used just four decoys to hunt a small overflow slough where a river had spilled out of its banks earlier in the week. But that was enough. The birds spotted those two pairs quickly in the quarter-acre backwater, and for over an hour, there were steady flights of woodies and mallards circling and setting their wings to glide toward the small spread.

Unless it's a stormy day, figure on pulling the decoys and float hunting or stalking at 8 a.m. to work on the rest of your limit. Also, blowing a call can help when birds are reluctant to come in close enough for a good shot.

Ponds and Potholes

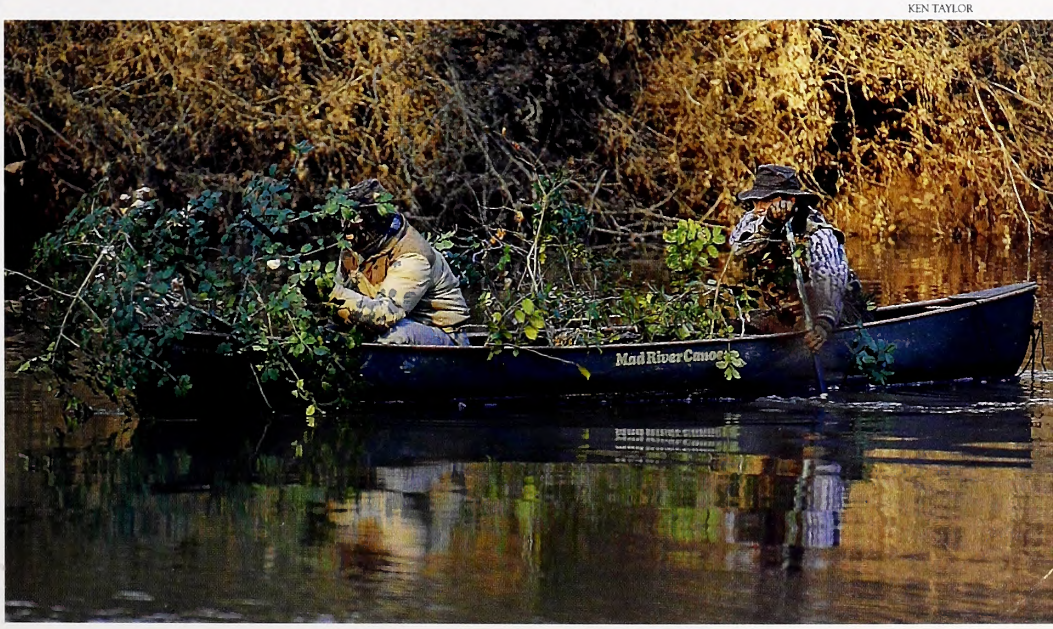
The U.S. Fish & Wildlife Service estimates that a pond lies within 10 miles of 80 percent of the U.S. population. Add to those still waters countless beaver dams and potholes, and you have a vast array of

conjunction with float hunting. If you spot a group of ducks far ahead but there's no cover for a direct approach, pull off to shore and send one hunter on a circular stalk so he comes in even with or just downstream from the birds. When he flushes them, chances are they may fly upstream past the other hunter waiting by the boat.

Wear camouflage or drab-colored clothing when jump shooting, and sneak quietly parallel to the stream. If cover is thick, you can stay close to the bank. If it's sparse, walk 15 to 30 yards back from the water's edge, but loop up close to the bank every 40 to 60 yards or so to check for ducks. Use any cover available, such as stumps or trees, as you move up to the water.

The third method that's useful for North Carolina river ducks is setting out decoys. You can put up a small portable blind, build a quick one from shoreline brush or simply

KEN TAYLOR



duck-hunting spots to make use of. These require no long, predawn drives, no expensive lease or guide fees and no drawings for permits to fool with. In short, no hassles. Ponds also offer solitude, something you can't always find on larger popular duck hunting areas.

You can locate these miniature duck habitats by driving country roads and stopping to visit with farmers and wildlife officers. Topographic maps are also good ways to pinpoint small duck waters. Check them out before the season, looking for feathers and droppings that indicate ducks have been using the pond.

Two strategies work well for ponds—jump shooting and setting decoys. Jump shooting is the easiest and most straightforward method. It's also exciting, starting with the initial search for game, then a careful stalk into range that can mean hunching down or even crawling on knees, followed by a flurry of intense, close-range shooting.

Try to get a look at the pond from a distance to determine which side the birds are holding on and what topography will offer the best approach. Often coming up behind the dam may be best, but brush, trees and gullies can offer other approach options. Get as close as possible before rising up to flush the birds, preferably 30 yards or less. Two hunters can approach the pond together, a few yards apart, if you know the location of the birds. If the pond is large, and you don't know where the ducks are positioned, it may be better to move in from different locations, to ensure that at least one person gets some shooting. Be extremely careful that you're not shooting in the direction of your partner, however.

When a flock of three to 50 birds suddenly rises up, it's important to force yourself to select one target to aim at. If you drop that bird, only then should you try to pick out another one in range and shoot at it.

A good retriever can be a big plus. If you don't have access to such a dog, be sure to bring waders so you can retrieve fallen game. A rod and reel with a treble-hook lure can also be used to snag ducks and pull them to shore.

The second tactic used for ponds is waiting for the birds to come to you. You can use two methods—either get into the pond before daylight and await the ducks' return, or flush them off without shooting and wait for them to come back. With either approach, the technique is basically the same. You're relying on the appeal of that resting area to bring in the birds.

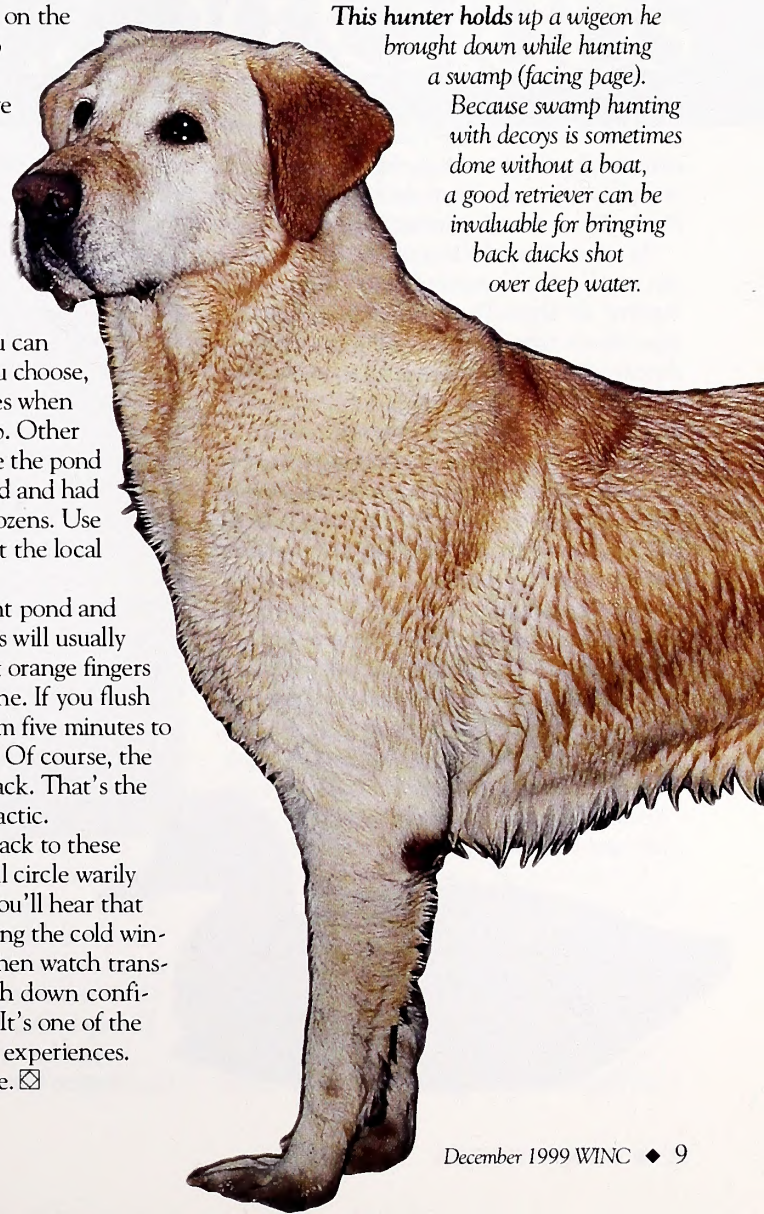
If ducks are on the water, try to flush them off subtly and quietly, in small groups. Just let a few of the most alert birds barely see some movement as you approach, then hunker down and let those fly off. Then move a bit closer and alarm a few more ducks into flushing. You don't want to scare the daylights out of them, just worry them a bit, so they won't be reluctant to return. If the birds leave in scattered small groups, chances are they'll come back the same way, sporadically, in small flocks that offer extended shooting opportunities.

Never shoot at the birds on the flush if you expect them to return. Make your choice. Either jump-shoot and move to another pond, or flush the birds off quietly and hope they'll come back.

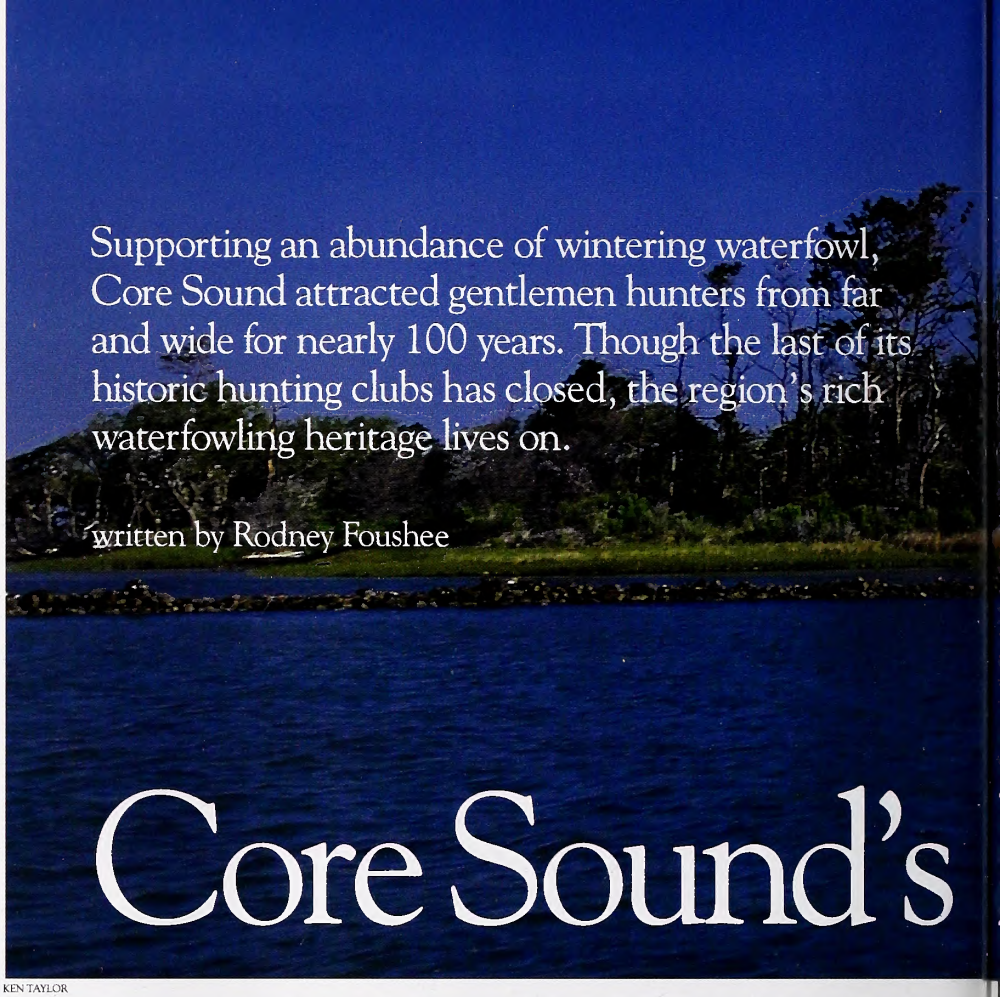
Whether you've flushed the birds off a pothole or snuck into the pond or slough before daylight, the next steps are the same. You can set out six to 12 decoys if you choose, or skip them. I've seen times when the decoys appeared to help. Other times, I've just waited beside the pond in brush or a makeshift blind and had birds pour back in by the dozens. Use your judgment and see what the local birds seem to require.

If you've chosen the right pond and set up before daylight, ducks will usually come pitching in as the first orange fingers of dawn illuminate the scene. If you flush birds off, expect to wait from five minutes to an hour before they return. Of course, the ducks won't always come back. That's the chance you take with this tactic.

When the ducks come back to these small bodies of water, they'll circle warily at first. But soon enough, you'll hear that thrilling rush of wings beating the cold winter air as they drop closer, then watch transfixed as they suddenly pitch down confidently into shooting range. It's one of the sweetest of all waterfowling experiences. And it can be tasted for free. ⊠



***This hunter holds** up a wigeon he brought down while hunting a swamp (facing page). Because swamp hunting with decoys is sometimes done without a boat, a good retriever can be invaluable for bringing back ducks shot over deep water.*



Supporting an abundance of wintering waterfowl, Core Sound attracted gentlemen hunters from far and wide for nearly 100 years. Though the last of its historic hunting clubs has closed, the region's rich waterfowling heritage lives on.

written by Rodney Foushee

Core Sound's

KEN TAYLOR

They boarded iron horses in New Jersey and New York to escape the bitter winter and the stresses of the boardroom. After a leisurely dinner in the first-class car, a snifter of cognac and a fine cigar, they retired for the evening. These northern captains of industry—steel and railroad tycoons mostly—awoke the next morning a world away in North Carolina.

They came for pintails and canvasback; they came for scaup and geese. They came for a respite from the busy world that they created, dominated and owned, these well-to-do Yankee sportsmen. In pursuit of waterfowl, they established hunting clubs, great and small, along the North Carolina coast. Many came to Core Sound, where the redhead was king.

Sheltered from the harsh Atlantic Ocean by the Core Banks to the east, Core Sound's productive waters, stretching some 30 miles from Cape Lookout to Portsmouth Island, provided a rich nursery for fish and a winter haven for waterfowl. These bountiful waters sustained native peoples and settlers alike for generations. For wealthy northern sportsmen entering the 20th century, this was the perfect place to escape from the hustle and bustle of the booming Industrial Age.

In other areas of the state, such northern gentlemen were called "sportsmen," or "sports" for short. But on Core Sound, they were always referred to as "hunters." From shortly after the Civil War until the Great Depression, they descended on North Carolina's coastal marshes in ever-increasing numbers on wintertime pilgrimages to pursue ducks and geese. These sportsmen built fine hunt clubs on Core Sound, bought its marshes and employed local people as guides, decoy carvers, cooks, boat polers, caretakers and guards for their clubs. Not only the powerful but also the famous hunted from these clubs on Core Sound, including future president Franklin D. Roosevelt and baseball slugger Babe Ruth.

THE CLUBS

Though several smaller hunting clubs and lodges were established in the area, there were four major waterfowl hunting clubs on Core Sound. From north to south, they were the Pilentary Hunting Club, the Harbor Island Gun Club, the Carteret Gun and Rod Club and the Davis Island Hunting Club. All were established and their clubhouses constructed around the turn of the century. Both the Pilentary and Carteret clubs were built on Core Banks proper. The remaining clubs—along with a fifth club, the Hog Island Hunting Club, constructed in the mid-1940s and having members from the abandoned Harbor Island Gun Club—were established on islands in Core Sound.

KEN TAYLOR

With few exceptions, the membership of the Core Sound clubs during their heyday came primarily from New York and New Jersey. Though all of the clubs were upscale, none compared to the opulence of the Pilentary Hunting Club. Named after the pilentary tree, or sea ash, *Zanthoxylum clava-herculis*, a spiny, smallish tree native to the Outer Banks, the Pilentary was established on Core Banks in the late 1800s. However, the crown gem of the club—its magnificent clubhouse—was not completed until around 1905, when a wealthy New York industrialist named Jordan L. Mott III purchased the property.

Isolated on a thin strip of sand between the Atlantic Ocean and Core Sound, the Pilentary clubhouse was the lap of modern luxury. The two-story clubhouse had fireplaces on both floors, with wood used for heating and coal for cooking. Two large cisterns caught water that drained from the roof by gutters. The water was transported via a mechanical pump to a 500-gallon copper tank in the attic. A pipe allowed water to flow to a stove with a reservoir that provided hot water for bathing and other needs.

In the top echelon of society, Jordan Mott and his wife, Kitty, hobnobbed with the likes of the Vanderbilts, the Roosevelts and even the German kaiser. The Pilentary Club offered Mott a refuge from extensive European travels and the social demands of city life.

Between 1905 and 1920, Jordan Mott, along with family and guests, often made the journey from New York to eastern North Carolina via train. A local captain would pick up the party in Beaufort and ferry the group out to the clubhouse on Core Sound in one of the club's two powerboats.

Sturdy hunting blinds—partially submerged pit blinds and raised stake blinds—were constructed in the marshes and the sound around the club. Transportation to the blinds along the sandy banks was provided by oxen-drawn wagons. Once the hunters were safely delivered to their blinds, the oxen could be driven into the

Historic Hunting Clubs

***Though no longer** used as a hunting lodge, the "Big House" of the Davis Island Hunting Club stands as a reminder of Core Sound's colorful waterfowling past. The chance at plentiful ducks and geese once brought hunting parties (left) from near and far to eastern Carteret County.*

shallow, icy water with a wagonload of wooden decoys, which were carefully placed around the blinds by guides.

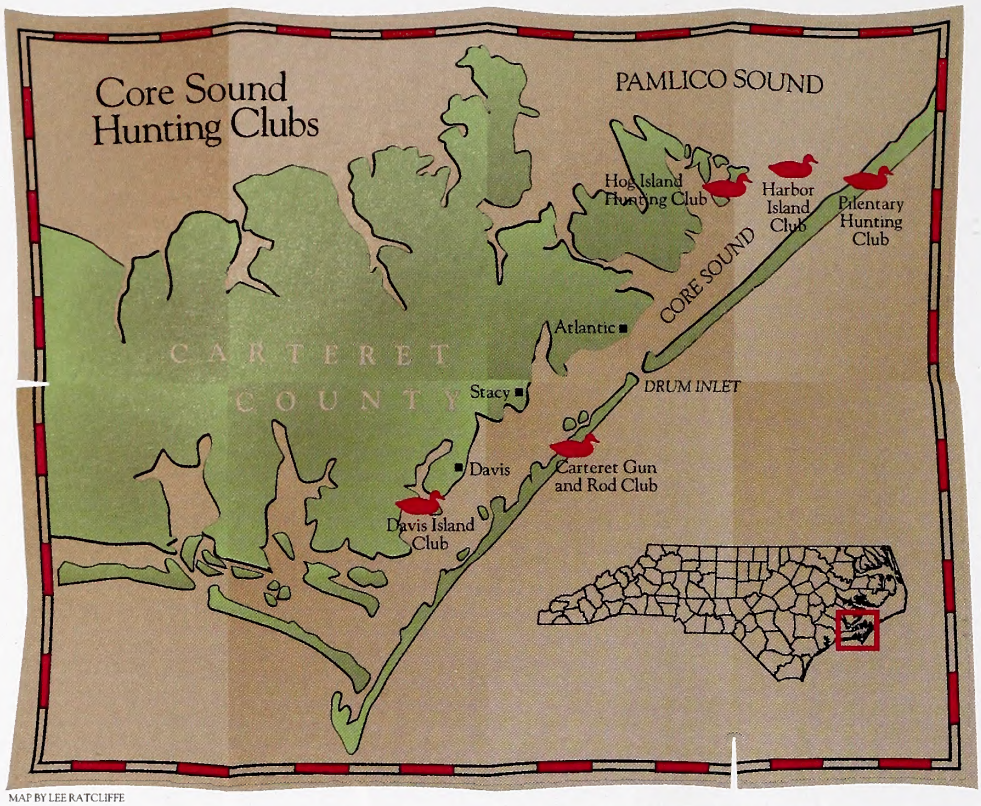
If live decoys were employed—mainly Canada geese—the birds were tethered by one leg with a leather thong to a short piece of rope staked to the bottom of the sound. When wild geese flew overhead, the staked birds honked, luring them into the range of the gentlemen's shotguns. (Mott and his guests generally used double-barreled guns, each hunter carrying two loaded guns to the blind. Jordan Mott's personal favorite was a double-barreled Parker with gold triggers.)

Even during Core Sound's hunting heyday, the birds weren't always cooperative. On bluebird days, when the ducks refused to fly, Mott would relax in his blind by painting or reading.

Mott and his family loved to entertain guests at the Pilentary Club. Baked fowl stuffed with oysters was often served as the main course for dinner. Both delicacies were plentiful on Core Sound. The fowl were drawn and hung on nails in a woodshed to be cooked at the club or shipped in barrels, along with many bushels of oysters, back to New York.

A young and vibrant Franklin Roosevelt, then assistant secretary of the navy, was the club's most famous guest. He hunted with Mott at the Pilentary Club in December 1915.

Despite obvious differences in social class, there was little resentment of the club members among the local populace. "All of the caretakers, cooks and guides at the clubs were locals," explained Roy Willis, 66, a Stacy native and lifelong hunter and decoy



MAP BY LEE RATCLIFFE

***Sheltered by Core Banks** from the angry Atlantic Ocean, Core Sound's productive waters proved a fine place for duck hunting clubs in the early 20th century. Though they drew their membership primarily from the northeastern United States, the Core Sound clubs employed many local people as hunting guides, decoy carvers, cooks and caretakers. Local carpenter Raymond Paul, right, built both the Davis Island Club's main lodge (page 11) and the buildings of the Carteret Gun and Rod Club (right).*

carver. "The clubs gave people jobs and a way to earn extra money."

They also opened the door for modern conveniences in eastern Carteret County. For example, the Carteret Gun and Rod Club, later renamed the Core Banks Rod and Gun Club, had telephone service long before the mainland community of Davis just across the sound. People from the community often visited the clubhouse and were allowed to use the telephone, with amazement. And the northern sportsmen weren't all tyrants, either. Jordan Mott himself allowed local men to hunt in the marshes around his club and even named some the surrounding islands after the children of his caretaker, Alvin Mason.

Core Sound's greatest decoy maker, Mitchell Fulcher, worked for many years as a guide at the Carteret Gun and Rod Club. Fulcher, infamous for his temper, was a master carver who set the standard for other decoy makers in the region.

"His decoys were better than anyone else's," Willis said. "He didn't make a whole bunch of 'em, but everything he did, he did to perfection." Willis has about a dozen Fulcher decoys in his collection of nearly 2,000, including four black duck decoys and a pintail Fulcher made for Willis' grandfather.

"Pintails were his specialty," Willis said. "Mitchell Fulcher didn't like making a black duck. He was a man that cursed a lot. If you asked him to make a black duck, he would cuss half a day over that. Somehow my grandfather got him to make four black ducks; they were good friends."

DECLINE OF THE CLUBS

Though some waterfowl hunting continued on Core Sound, much of the activity at the clubs ceased during the Great Depression, with many members losing their shirts in the economic fallout.

"Most of the clubs went down after the stock market crash (in 1929)," Willis explained. "The members on Davis Island never came back after the crash. I guess they lost all of their money. The caretaker got all of the club's guns and decoys."

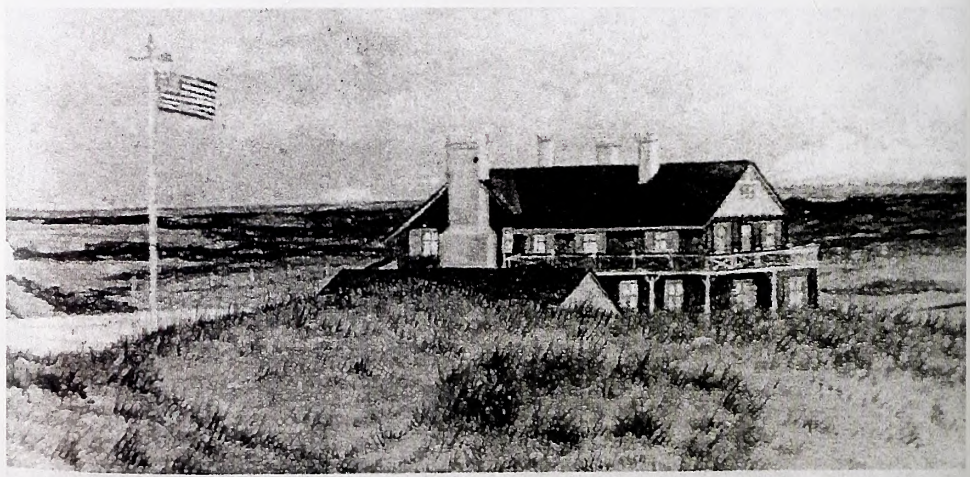
During the late 1930s and 1940s, hunting on Core Sound picked back up nearly to its former level, as the clubs became more active. Though outlawed, the use of corn to bait ducks and geese continued at a fervent pace. Locals joined in on the shooting from their own blinds.

"I lived out across from the Core Banks Club on the mainland," Willis said. "Ever since I started hunting, that's where we hunted. [Club members] put out the feed, and they had the ducks and the blinds. We had blinds right in amongst their blinds," he said. "So we didn't have to feed the ducks. All we had to do is just go hunt."

Rafts of thousands of redheads and scaup were common sights on Core Sound, fueling a feverish pace of hunting as late as the 1940s.

"I started hunting when I was 10 years old," Willis said. "I remember hunting with Daddy's double-barreled shotgun in a skiff around the edge of the sound. Back then there was so much hunting in the sound you could walk around the shore and kill cripples —ducks that had gotten shot earlier with a leg broken or a wing. As a young'un that's how we started out. We'd just go out and get a pole skiff and pole around the shore looking for cripples."

Times would change for the worse in the following decades, as waterfowl numbers began to plummet on Core Sound and in many other areas due to habitat changes, including the draining of wet-



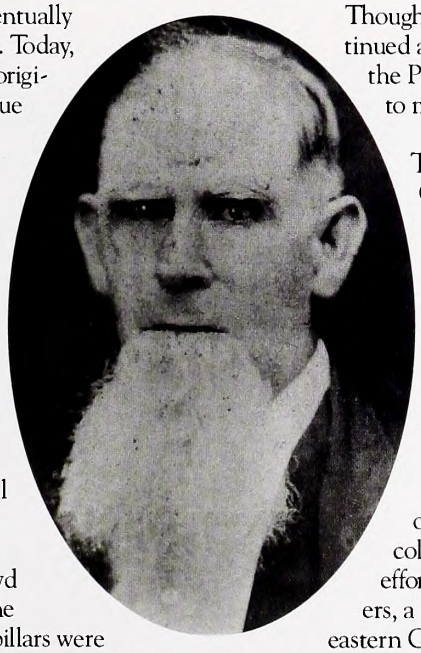
PILANTARY POINT ROD & GUN CLUB - N.C.

PAINTED BY POPPA JORDAN. DESTROYED IN HURRICANE - 1933

lands in critical northern breeding areas. The situation became so grave that the hunting season for redheads, Core Sound's prized species, was closed for a decade beginning in the early 1970s.

The ravages of time and the elements also took a toll on Core Sound's hunting clubs. The great storm of 1933—an unnamed September hurricane—severely damaged the Pilentary Club's grand clubhouse and destroyed all its outbuildings. For years, all that remained of the club was a cistern. The clubhouse was never rebuilt, and today there is only a sandy strip of beach where the opulent club once stood.

The Harbor Island Gun Club was similarly damaged by several storms in the 1930s but was renovated in 1937. It remained viable for another 10 years but eventually succumbed to the elements. Today, less than a half acre of the original 5-acre island remains, due to erosion. Though badly damaged, portions of the original clubhouse walls are still visible.



The original clubhouse of the Carteret Gun and Rod Club, built around 1902 by Raymond Paul, burned in 1970. A new clubhouse, for the Core Banks Rod and Gun Club, was built and maintained by members through the fall of 1999. The Hog Island Hunting Club was severely damaged by Hurricane Floyd last September. Many of the clubhouse's main support pillars were destroyed and the structure itself is falling into the sound.

Though no longer used for hunting, the privately owned and maintained "Big House" of the Davis Island Hunting Club is the only original clubhouse that remains in good condition.

The last of the historic clubs and the longest to stay in operation—the Core Banks Rod and Gun Club—was set to close its doors for good last month. Effective November 23, ownership of the club was to be turned over to the National Park Service, which controls all 56 miles of Core and Shackleford banks as part of the Cape Lookout National Seashore. The last owners of the club—13 members, mostly from Piedmont North Carolina—were active until last fall.

"The members fought with the Park Service a long time to keep the club, but they lost," explained Gregory Dudley, the Core Banks Club caretaker. The Park Service had taken ownership of the land years ago, when the national seashore was formed,

HISTORIC PHOTOS COURTESY OF JACK DUDLEY

but allowed the club to operate under a 25-year lease. That lease ended in November, and the Park Service refused to extend it, Dudley said. "This is it," he said. "The last of it. The end of an era."

Though activities will be discontinued at the Core Banks Club, the Park Service has agreed to maintain its buildings.

THE PEOPLE'S CLUBHOUSE

Despite the disappearance of the historic clubs, the popularity of waterfowling has never been stronger on Core Sound. Sure, duck numbers, including redheads, are on the rebound. But there's more to it. Thanks to a dedicated following of decoy and wildlife art collectors and the grass-roots efforts of thousands of supporters, a dream is coming true in eastern Carteret County—the Core Sound Waterfowl Museum.

Mostly with private donations, supporters have raised more than $1.5 million to make the vision of a permanent facility to showcase the region's waterfowl heritage a reality. More than 10,000 people annually attend the Core Sound Decoy Festival—in its 12th year—to celebrate that heritage and support the museum effort.

Already under construction, the museum will include new permanent offices and an educational area that will open this spring. Exhibit areas are slated to open in two to three years, depending of course on financial contributions. (The total cost of the museum and exhibits is estimated at $3 million.) Judging from the popularity of the decoy festival, that doesn't seem unrealistic.

When completed, the 20,000-square-foot facility on Harkers Island will be big enough to house plenty of the artifacts and memories of the region's rich waterfowl legacy, including priceless decoys, guns and photographs.

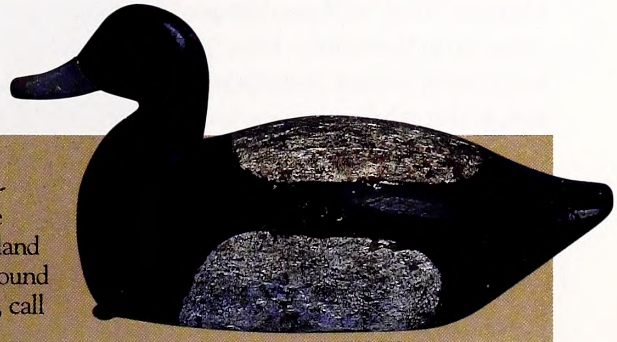
But the Core Sound Waterfowl Museum will be far from a tomb housing relics of the past, explained museum director Karen Amspacher. "This won't be a museum about saving artifacts, but a living tribute to the past, present and future of Core Sound and its people," she said. Besides exhibits, the facility will feature educational programs such as decoy carving, net making and boat building, all demonstrated and taught by local people. Such an undertaking should ensure that these coastal traditions live on well into the next century.

With its spacious galleries, traditional coastal architectural style and 60-foot-tall observation deck overlooking all of Core Sound, even Jordan Mott III and cantankerous ol' Mitchell Fulcher would be proud of the new museum. You will too. ⊠

Jack Dudley, of Morehead City, provided invaluable assistance in producing this story. For a complete history of Core Sound hunting clubs, guides and decoy makers, consult his book, Carteret Waterfowl Heritage, *published by* Decoy Magazine, *1993.*

Decoy Festival

For a firsthand look at the decoys, traditions and people that make up Core Sound's rich heritage, visit Harkers Island Dec. 4-5 for the 12th Annual Core Sound Decoy Festival. For more information, call (252) 728-1500.

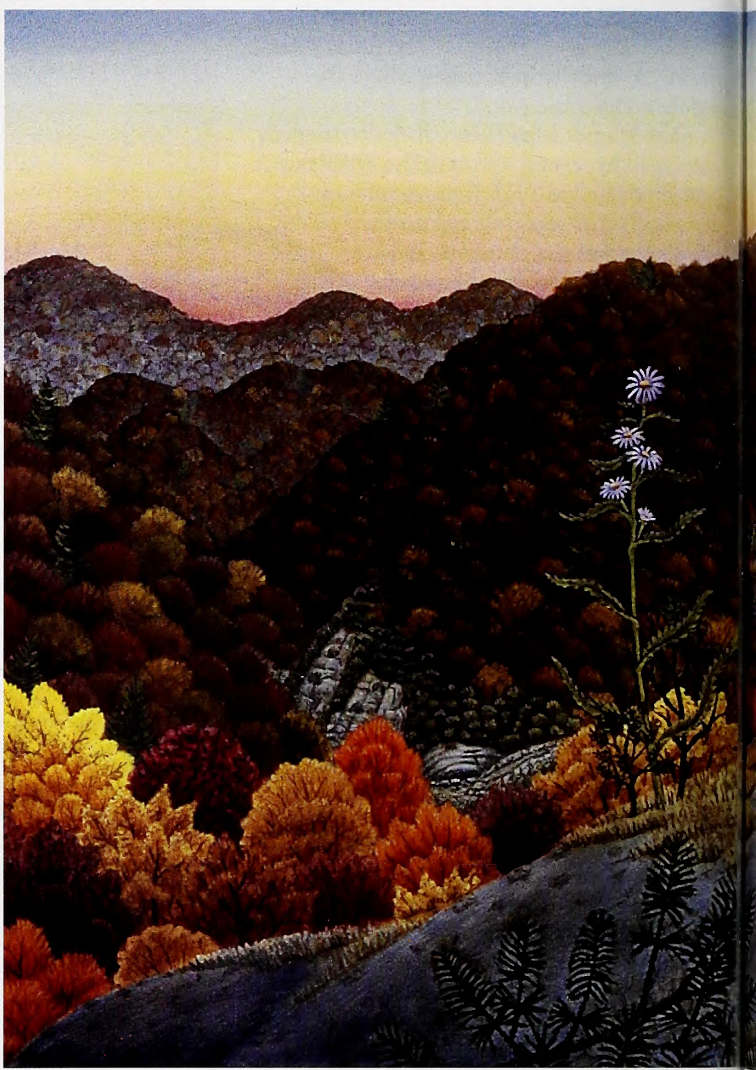


KEN TAYLOR

a REVERENCE for NATURE

When Robert Johnson decided to paint some of The Nature Conservancy's outstanding preserves, he brought an eye for color and a spirit of originality to the task.

paintings and sketches by Robert Johnson ©1999



Robert Johnson's nature paintings are colorful celebrations of some of North Carolina's most wondrous natural areas. In his pictures you can always find accurate depictions of plants and wildlife, but photographic realism is not what Johnson is after in his work. Indeed, his paintings are interpretations of what he sees, subjective records of his experiences at a certain place.

"A camera picks up everything and that makes a photo too confusing to me," he says. "I try to pick up form and visual patterns in my paintings. I'm after something other than a naturalistic rendering."

In *Panthertown Valley*, for example, the blue aster is as tall as a tree, and so is the yellow pitcher plant in *Horseshoe Lake*. Why does the artist take such liberties with his subject matter?

"I have two explanations," Johnson says. "First of all, it allows me more freedom in my compositions. I can make anything any size I want. Say I need a spot of red. If I were to paint a flower its actual size, there would be this tiny spot down there. That wouldn't fulfill my need for a big spot of red. So it gives me more freedom to compose shapes and colors. So in *Panthertown Valley*, if I made the aster its actual size, it would barely be there. I needed it to be big and leaning into the picture, so that it brings your eye back into that part of the painting.

"The other thing is that I'm trying to capture the whole experience of being out there. And to my mind, that has as much to do with my looking at that aster carefully, seeing its incredible color, as it does seeing the scene."

Not that the place itself is given short shrift in Johnson's work. In previous work in the 1990s, on North Carolina's state parks and coast, Johnson revealed a consuming interest in the natural areas of the state. His latest project, "The Nature Conservancy Series," from which these paintings are taken, represents a collaboration between himself and the Conservancy, a private conservation organization that has been responsible for preserving nearly 450,000 acres of important natural communities in North Carolina.

Beginning in 1998 and ending in the spring of 1999, Johnson painted 10 different sites protected by the Nature Conservancy—Bluff Mountain, Panthertown Valley, Nags Head Woods, the "Green Sea," (an area in the northern part of Currituck Sound), the Roanoke River, the Green Swamp, the Black River, the Sandhills, Horseshoe Lake and Grandfather Mountain.

"Going around to these sites was like being a pilgrim during the Middle Ages and going to the holy sites of Europe—the cathedrals,"

"When I was there...I saw much evidence that black bears like to make this beautiful valley their home."

he says. "I think there is something that is spiritually uplifting when you go to a natural area that is particularly beautiful, just like the way that a beautiful painting can lift you out of yourself."

To paint these often sprawling natural areas, Johnson immersed himself in each site, spending as many as two weeks exploring and sketching. He typically spends a morning or afternoon in a single spot, sketching in pencil what he sees and hears, attuning himself to the spirit of the place. Returning to his camp in the evening, he colors in the sketches with watercolors. Finally, back home in his forest studio in the mountain community of Celo, he uses acrylic and oil paints to make the finished painting.

Born in Washington, D.C., Johnson grew up in Caracas, Venezuela, and then went to prep school in Pennsylvania and to the University

PANTHERTOWN VALLEY
oil and acrylic on canvas
20"H x 44" W

◀ *notebook sketch*

of Louisville. He apprenticed with Mark Rothko and Carl Knaths in Provincetown, Mass., and attended graduate school in California. In 1973 he settled in Celo, where he has lived and worked ever since.

Johnson admits that it has taken nearly all his artistic life to discover his true subject matter—his love of nature and of wild places. For 26 years, North Carolina has been his home and the subject of much of his painting. Johnson fears that the state is growing so fast that people are losing touch with the natural environment.

"My ideal is that we learn to integrate ourselves with the natural environment—so we are not separate from it," he says. "I don't think we're doing that now. We have the natural environment over here preserved in parks and natural areas, and human culture over there in cities and towns. That's why preserving these ecosystems, which is what the Nature Conservancy does, is so important. When we learn to take care of ourselves and our world, these places will be here for us."

—*Lawrence S. Earley*

"When I reached the top, I found a whole other world floating high above the hustle and bustle of the everyday existence down below. ... At Molly Mountain, across from Bluff Mountain I found a cleared field with more than 150 home sites marked out for development. This kind of 'progress' could very easily have taken place up on Bluff Mountain, had it not been protected."

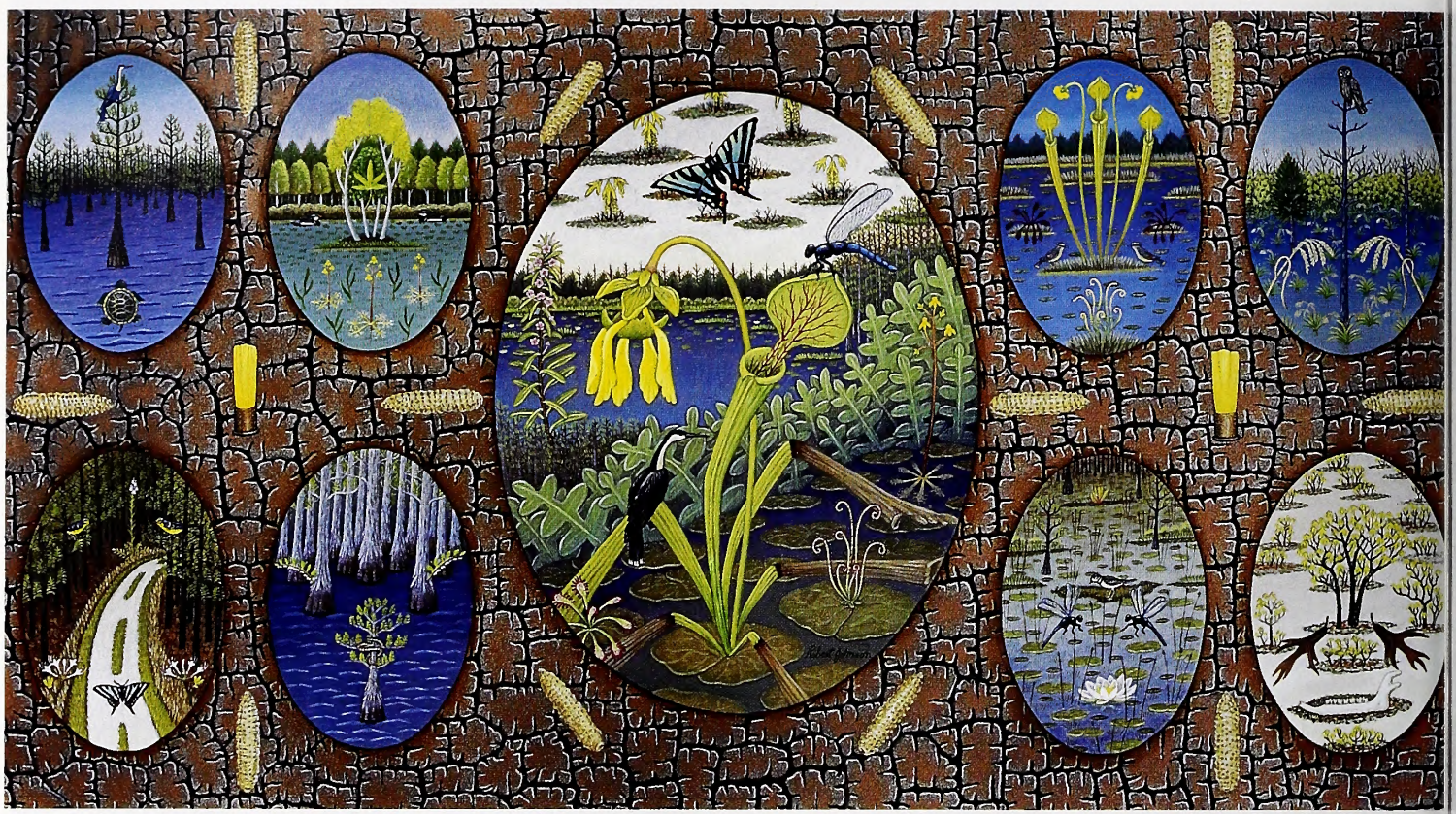
BLUFF MOUNTAIN
oil and acrylic on canvas
64"H x 48" W

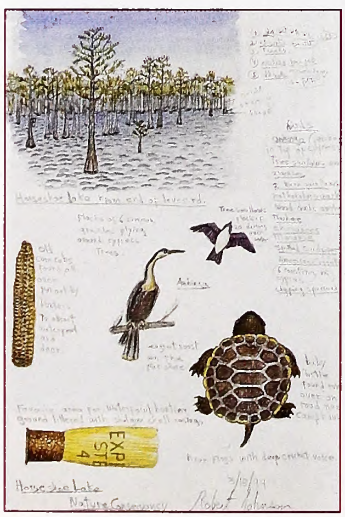
▲ *notebook sketch*

SANDHILLS LONGLEAF PINE
oil and acrylic on canvas
44"H x 34" W

▲ *notebook sketch*

"The Sandhills area is home to Fort Bragg, Pinehurst and many tree farms managed for pulpwood and pine straw. The main feature of the natural environment is the extensive growth of longleaf pine trees. These pines form an interesting ecosystem that is home to the endangered red-cockaded woodpecker and the unique fox squirrel. ... In the Sandhills Game Land, the forest is now maintained through controlled burning. I was able to observe the different stages of growth after a burn: from the tops of wiregrass totally burned off and young pine needles scorched due to a recent burn, to where the wiregrass comes in thick and lush and new needles grown on the young pines, to a mature forest which provides a home for woodpeckers and squirrels."





HORSESHOE LAKE
oil and acrylic on canvas
28"H x 52" W

◀ *notebook sketch*

"In the distant past, Horseshoe Lake was one of the typical oval-shaped bay lakes located in the southeastern part of North Carolina. … During my visit, I observed a spectacular display of trumpet pitcher plants with 3-foot-tall, trumpet-shaped leaves and magnificent yellow flowers growing in great profusion on these floating mats."

GREEN SEA
oil and acrylic on canvas
54"H x 46" W

"Every morning that I was there, I would see flocks of hundreds of snow geese flying overhead."

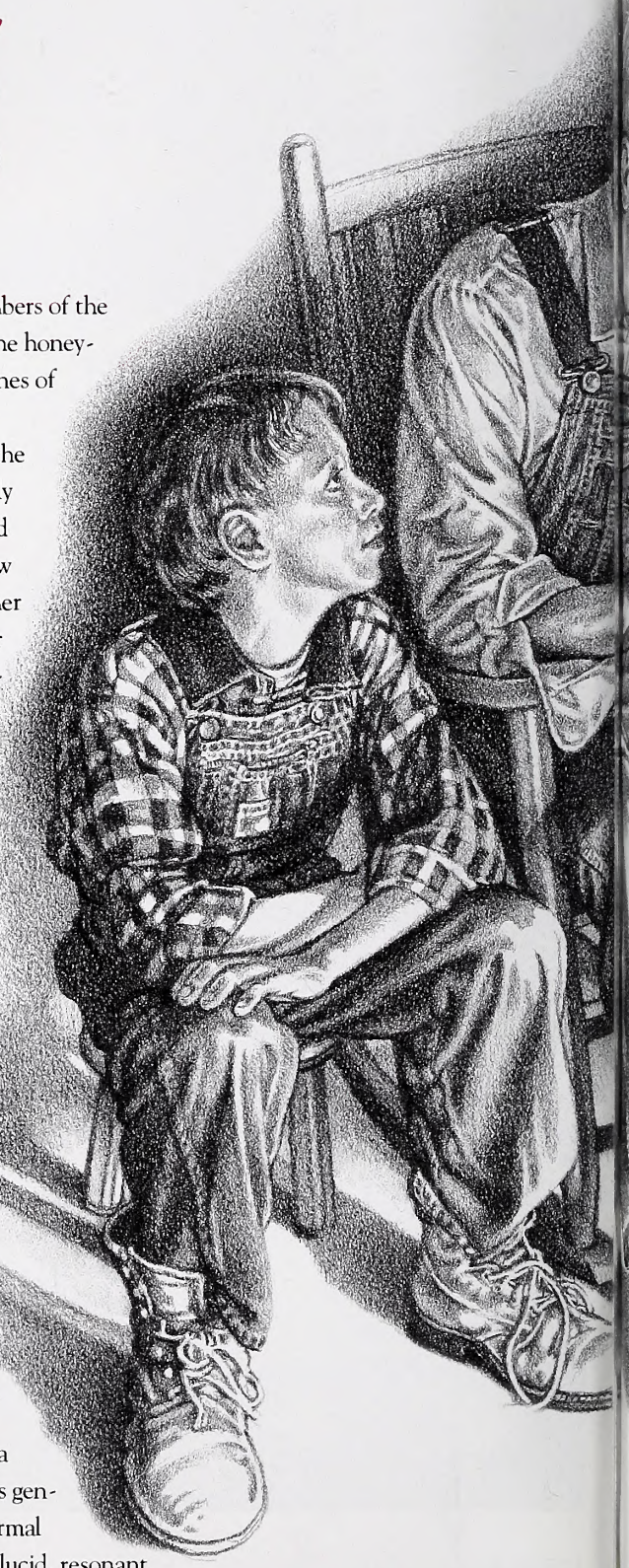
◀ *notebook sketch*

—Author quotes courtesy of *Robert Johnson: The Nature Conservancy Series*, Blue Spiral 1 (Asheville, 1999). ⊠

Ashworth SUNDAYS

He was the essence of kindness, the lesson the sixth grade forgot to teach. Somewhere in your family, there was probably someone like him.

written by Mike Gaddis ©1999
illustrated by Jim Brown ©1999



The bleached, disheveled timbers of the old house protrude above the honeysuckle like the scattered bones of a forsaken corpse.

The cedars that once soldiered the fence row straight and full are mostly gone, the few remaining, shabby and gnarled. Garden and grounds I knew so well in the green breath of summer lie sere under the leaden December sky. The desolation assails the innocence of my memory, and punctuates the years of his absence, yet it cannot displace his legacy. Gazing along the threadbare suggestion of the wagon path, I still sense his presence.

The proud script penned by his father into the worn, leather bible on the parlor secretary pronounced him William Manly Ashworth. The year was 1890 and it was the 22nd day of the Christmas month.

For three generations of us who arrived afterwards, he was simply and dearly Uncle Manly.

He was a large man for his day, standing 6-foot-3 in his prime and scaling maybe 220 pounds. A gentle person, he was blessed with a lusty voice and a ready smile and his generosity matched his stature. In a normal conversation, he could be heard in lucid, resonant tones at Union Grove Church, a good half-mile west. On a summer Sunday, in the years I knew my uncle, his perennial attire was a long-sleeved white shirt under a pair of clean, but well-worn overalls. In an era when most men of his generation wore hats, he went bareheaded, his full thatch of silver hair wetted and neatly groomed.

Ashworth SUNDAYS

He lived on the family homeplace, a small farm of 90-some acres in the red clay, white flint and buck-tallow of the Cedar Grove Community in Randolph County. The house—clapboards over logs—stood on a gentle swell overlooking meadows of butterfly weed, zephyr lilies, goldenrod and the shadowy bottomland skirting Taylor's Creek. It was a place of simple grace and charm, from the strength of the oaks bordering the farm path to the harmony of the blue gingham curtains behind the blownglass windows. When his nine siblings left to find their fortunes in the world, Uncle Manly discovered his in the place he was raised.

Uncle Manly was a confirmed bachelor. Whether by choice or happenstance, he lived alone. Maybe he loved and lost. I never knew. No doubt, there were times he was lonely.

But never on a Sunday. On Sundays, he welcomed the gathering of an extended family, which found its way back to ancestral beginnings, drawn by taproots and tranquil memories. Uncle Manly was forever at the epicenter of family life, the cornerstone of its commerce.

To the grown folks, he was the herald of simplicity and country values in a world increasingly complex and urbane.

To us "young'uns," he was a companionable mentor, oftentimes accomplice. Forever young at heart, he would welcome us with boyish anticipation, never tiring of our endless questions, rejoicing at our eagerness.

He knew the hidden woodland where the first trillium grew, the secret of a butterfly chrysalis, how to trick the door shut on a freshwater mussel with the stem of a straw. Deftly, he'd unravel the mystery of a quail roost; find the cool, cloying muscadines that hid themselves safe from frost under November leaves; fashion a pop gun that shot gum balls.

Do you know when the hazelnuts ripen along the slopes of the meadow? How the king snake gets its name? When it's safe to eat a persimmon? How buckeyes look when they first peek from their husk? He did.

Would kids today recognize the lyrical music of the wood thrush, the bubbling trill of the wren, the whipsawing of the whipoorwill? Has someone told them that snapping turtles won't turn loose 'til it thunders, that a bobcat jumps tree, that you can "squall" a coon? Has somebody explained about bee-trees, stinging nettles and Molly-pops? Have they been taught to pick a bird when the quail rise? Can they fashion a bow and arrow from a hickory sapling and some Dominecker feathers? Skin a snake? Turn a catalpa worm?

"Come," he would say. "The world is full of fascinations."

Along the alders that shadowed the creek banks in the shimmer of summer, where the brown water snakes resided, we wandered in a cluster, relishing the old man's words. By his side, we sat with the fishing poles he had whittled from a stick, catching redbreasts on hook and line from his overall pockets. We followed his reverent footsteps about the painted meadows, through the dusky bottoms, gaining respect for the world around us, and for ourselves.

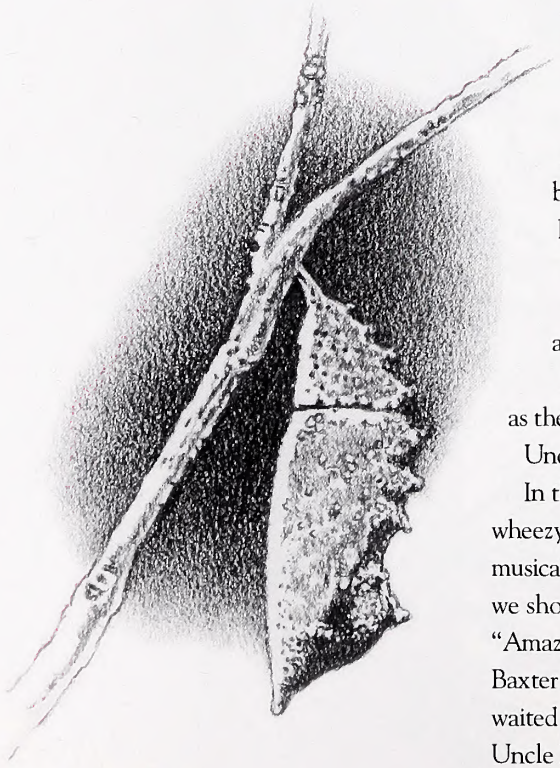
In a thousand ways, in a hundred places, we were taught that the least is as important as the greatest, and that a boy or a girl is simply one creature in a Kingdom.

Uncle Manly was the lesson the sixth grade forgot to teach.

In the grace of the old house, when Aunt Bessie instigated parlor hymns around the wheezy pump organ, we reveled in the comforting strength of his song. Unaccompanied by musical instruments and anchored by his rich baritone, 20 strong and four generations deep, we shook the house's moorings with strains of "Will There Be Any Stars in My Crown," "Amazing Grace" and "Rock of Ages." When Aunt Rachel railed in from Mississippi, and Baxter Skeen hauled in George Pegram and the Boys to renew his smoldering courtship, we waited anxiously for the "Boys" to blow into "Rocky Top." By then, inebriated by the feeling, Uncle Manly would explode into a spirited buck dance. Enthralled with his exuberance, we would clap and whoop, spirits soaring.

At the scuppernong vine in September, he would throw himself into an industrious frenzy,

the secret of a butterfly chrysalis...



picking from the top of the scaffold for the smallest of us and generally watching out for the women folk. On the return trip to the big house, he was ever vigilant for that year's round of Christmas trees.

"I'll be doggone if that ain't a pretty one, Joe!," he'd proclaim to my grandpa, calling us kids around to see the tree.

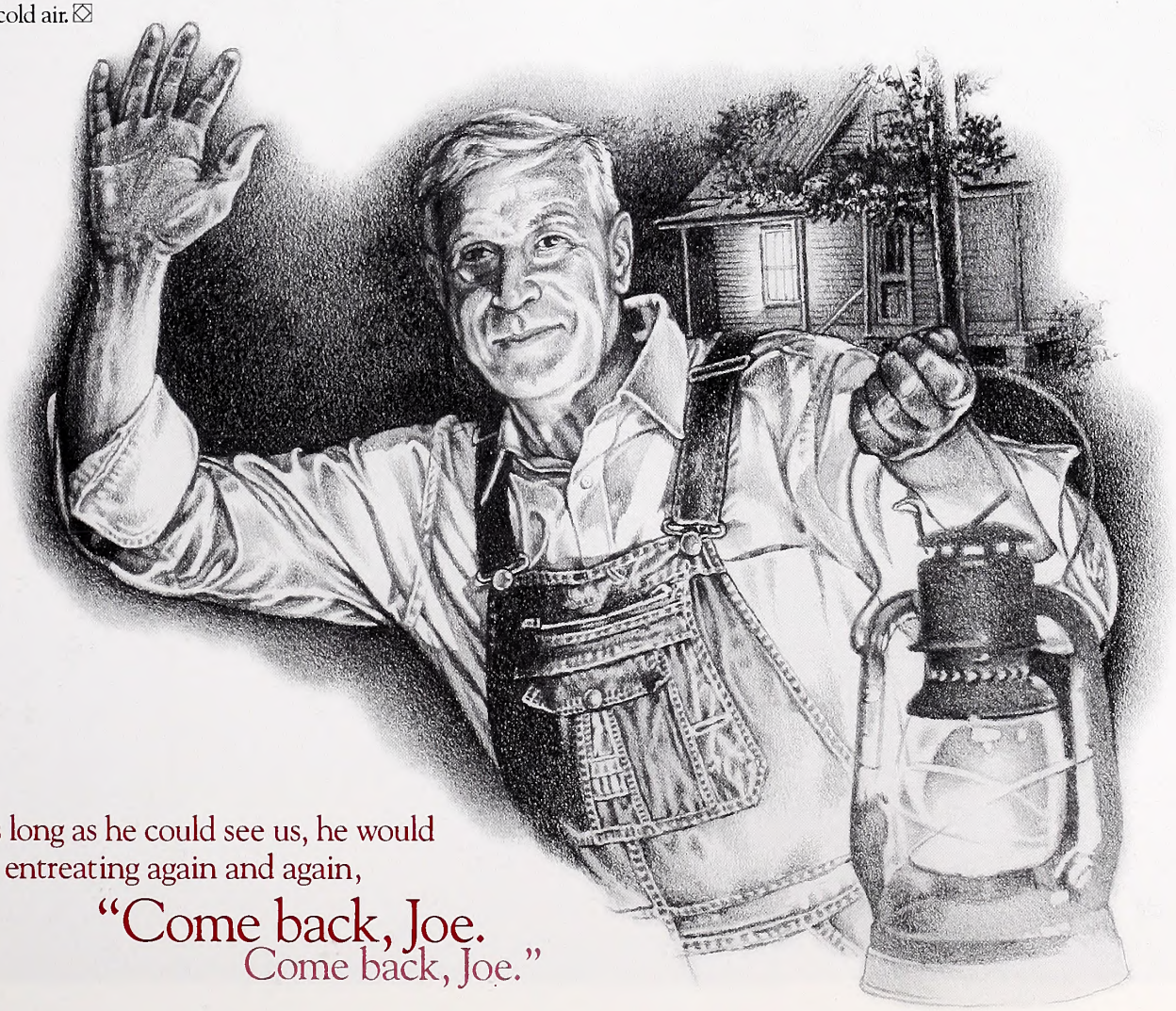
Before the flickering firelight on the eve of Noel, the room inundated with the scent of red cedar and baking sweet potatoes, the beagles kenneled and the rabbits hanging silvered and frosted by moonlight on the side porch, with the promise of the long-awaited morning dancing in our heads, he was old Father Christmas—the eternal countenance of gentility, giving and good will, the essence of innocence and sincerity, the harbinger of peace and joy.

I remember him most vividly at this season. Always he reminds me of how I began, how I should strive to live and why I love equally both mistletoe and doodlebugs.

He was a constant in a hundred childhood evenings. When it came time for farewells, he was everywhere at once, it seemed, clinging to the fleeting minutes and taken with the notion that the day would only end in success if he could extract a promise of return.

He would be standing by the path as we left, a lantern in hand amid the fragrant lilac, jasmine and honeysuckle that had melted into the cooling air of the rising evening, the clack of the cicadas and katydids in the foreground, the long, throaty "yeeeaahnnnks" of the toads, the whipsawing of a distant whipoorwill. For as long as he could see us, he would wave, entreating again and again, "Come back, Joe. Come back, Joe."

Dusk is falling now as well, almost 50 years later, as I turn from the lifeless old homeplace and make my way back along the faint wagon path. Yet I still hear him calling, ever so clearly in the quiet, cold air. ⊠



For as long as he could see us, he would wave, entreating again and again,

"Come back, Joe.
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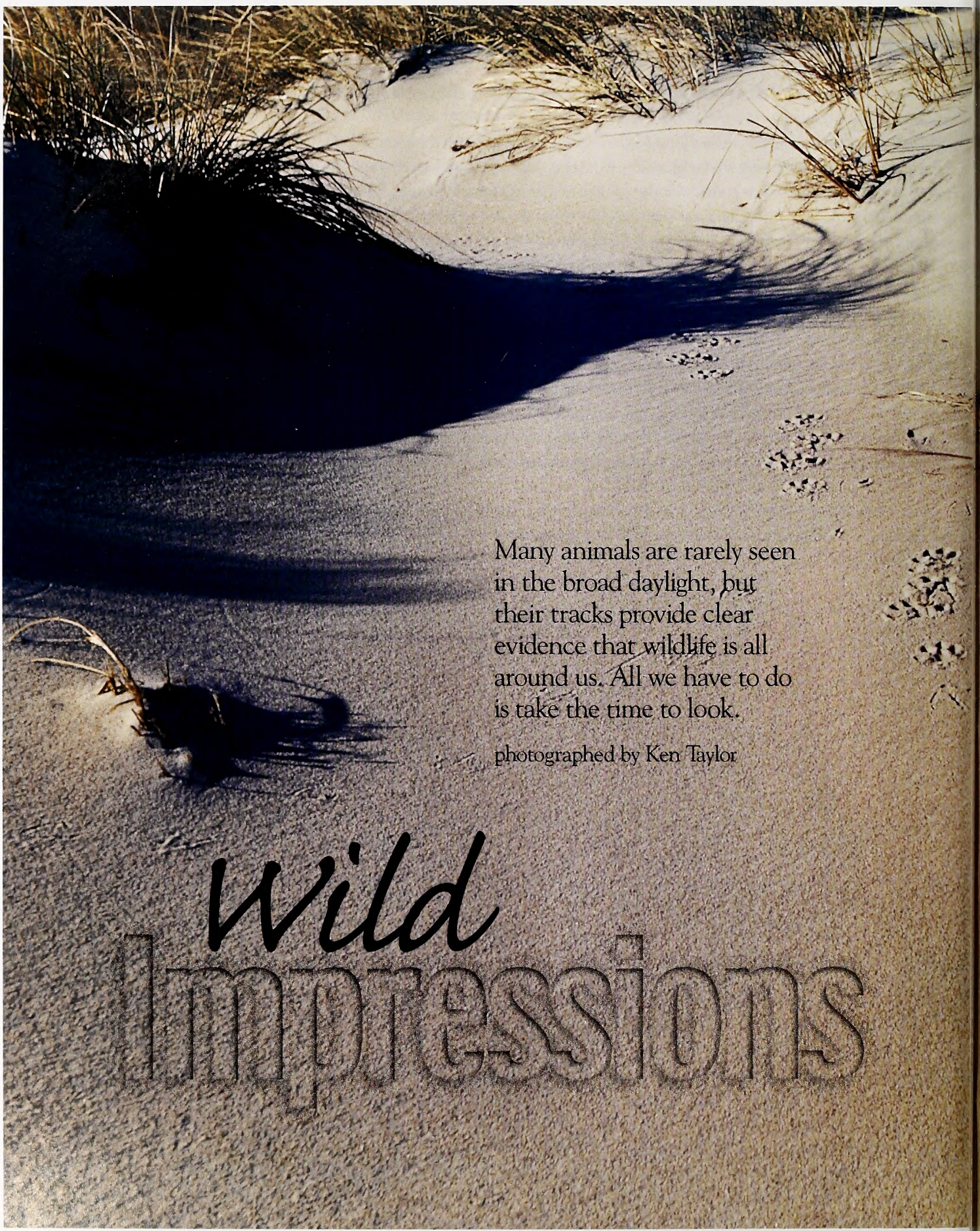


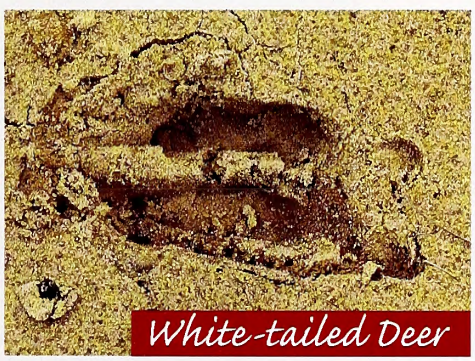
Wild Impressions

Many animals are rarely seen in the broad daylight, but their tracks provide clear evidence that wildlife is all around us. All we have to do is take the time to look.

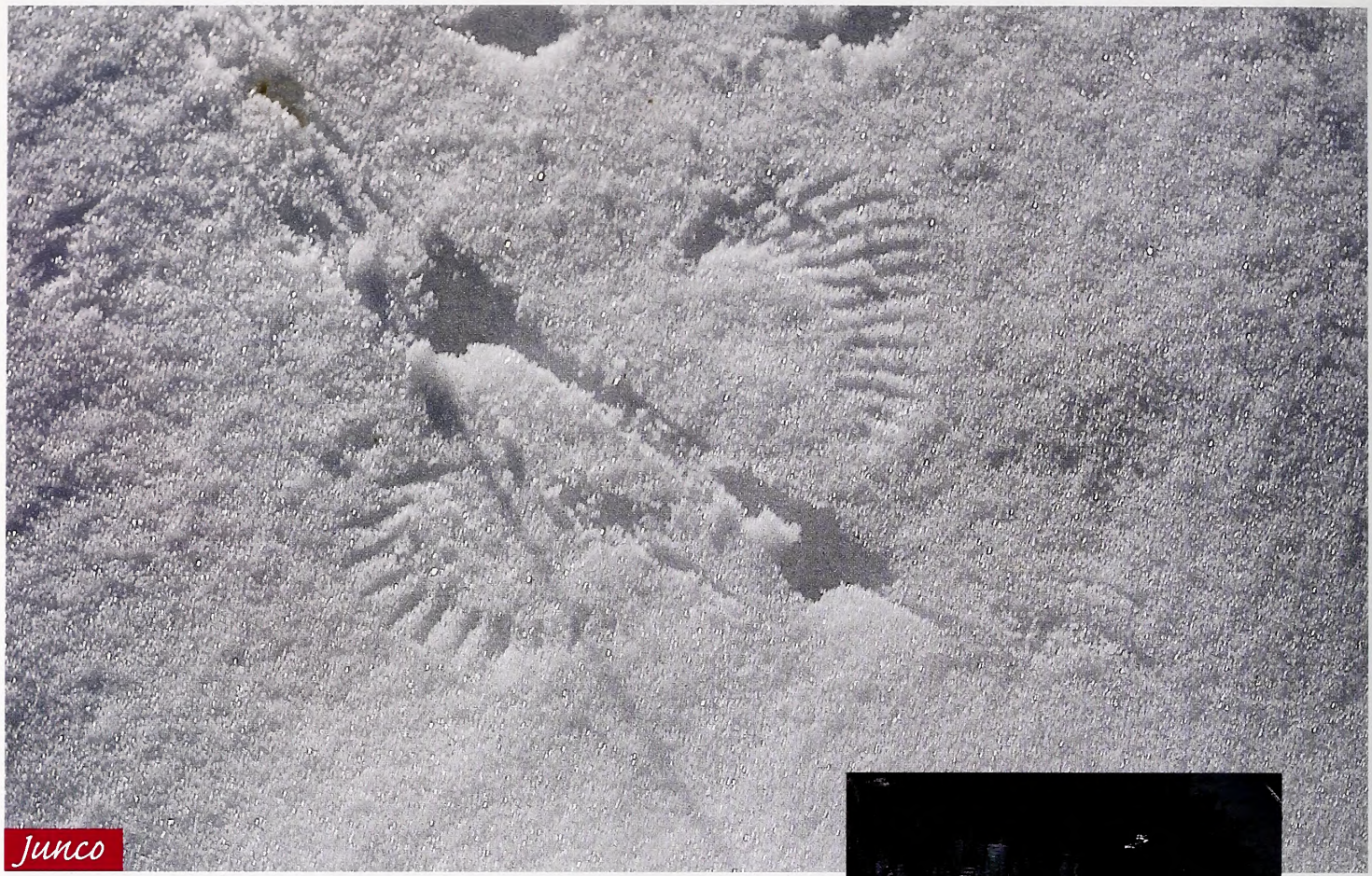
photographed by Ken Taylor

River Otter

Blame it on survival instincts honed over eons—most wild animals are masters of avoiding detection. Many wild creatures live secretive lives moving only under the cover of darkness or in the shadows of dusk and dawn. Others seek refuge in underground burrows or watery domains. And some animals are just so small that they escape notice. Though rarely seen, wildlife is all around us. A nearby wood lot is home to the deer, the raccoon and the fox. An overgrown stream hides the river otter and the mink. The thick forest shelters the black bear and the bobcat. The darkened, deserted



White-tailed Deer



Junco

Mink

Black Bear

Wild Impressions

beach provides a short respite for the sea turtle to lay her eggs.

Tracks—big and small—provide undeniable proof that wildlife abounds. Mud, sand, snow and dust—they all record the impressions of wildlife. The fresher the track, the closer we get to its maker. What a marvelous discovery—a fresh track. Life lingers in the impression.

Questions still remain—Where did this creature come from? Where did it go? Where is it now? One thing is certain—at least for as long as the track is visible—the creature was here. Right here. That's important. That's real.

If you take the time to look, you may very well make your own discovery. The woods and its wild creatures aren't far away. What are you waiting for?

—*Rodney Foushee*

Red Fox

Loggerhead Sea Turtle

If animals and plants did not interact with other animals and plants, our world would be very different. We would have no flowers or fruit and animals would not have any food to eat. All these interactions involve

Give and Take

written by Roger Powell / illustrated by Consie Powell

Hummingbirds pollinate flowers. Foxes eat rabbits. Rabbits eat clover and grasses. When animals and plants of different species interact, the interactions are usually predictable. Who gives and who takes? Interactions among plants and animals can be organized by how those interactions affect each of the interacting organisms.

YOU SCRATCH MY BACK; I'LL SCRATCH YOURS

Mutualism is an interaction that helps both organisms. Many flowering plants cannot reproduce unless their pollen is moved by an animal from one flower to another. Without a **mutualist** to move the pollen, these plants produce no seeds. To entice the mutualist animals, many plants produce nectar for the mutualists to eat. Hummingbirds, bats, bees, moths and butterflies are some animals that help plants by pollinating flowers.

Many other mutualisms exist. A lichen is an alga and a fungus cooperating. The alga produces food through photosynthesis while the fungus provides structure and absorbs nutrients from the soil. In many mutualisms, one member of the pair makes something to entice the other member into the interaction. Nectar and fruits are such enticements. When a bear eats blueberries and when a robin eats mulberries, the plant's seeds come out in the animal's droppings. The animals get food and the plants have their seeds dispersed to grow in new places.

trumpet honeysuckle

wild bergamot

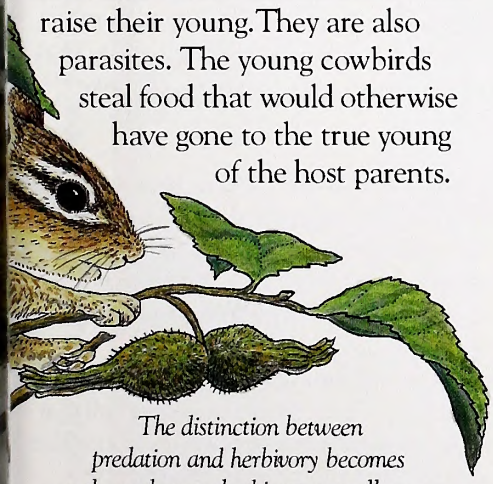
evening primrose

dwarf iris

Plants give us clues as to who their mutualists are. Orange and red flowers are usually pollinated by birds and butterflies, which can see red well. Blue or white flowers are favorites of bees, which see blue and ultraviolet well. Nocturnal bats or moths pollinate plants that bloom at night.

I'd Like To Eat You

Predation, **herbivory** and **parasitism** all help one organism while hurting the other. A **predator** kills and eats other animals. The predator gains a meal but the prey loses its life, clearly a help-one, hurt-the-other interaction. Bobcats, red foxes, redtail hawks and black rat snakes are predators. So are chickadees when they eat bugs, robins when they eat worms, and dragonflies when they eat mosquitoes. An **herbivore** eats plants. Rabbits and deer eat herbs, grasses and shrubs. Beavers eat aquatic plants and the bark of trees they cut down. A **parasite** steals nutrients from another organism, its **host**, but must not steal so much that the host dies. If the host dies, so does the parasite. Tapeworms living inside a red wolf, mistletoe growing high in an oak and ticks and mosquitoes that suck blood from your dog or you are all parasites. Cowbirds lay their eggs in other birds' nests and let those birds raise their young. They are also parasites. The young cowbirds steal food that would otherwise have gone to the true young of the host parents.



The distinction between predation and herbivory becomes unclear when an herbivore eats all or enough of a plant to kill it. When a chipmunk eats a hazelnut, the chipmunk kills the nut and the nut will never produce a tree. This is sometimes called seed predation.

I Need What You Need

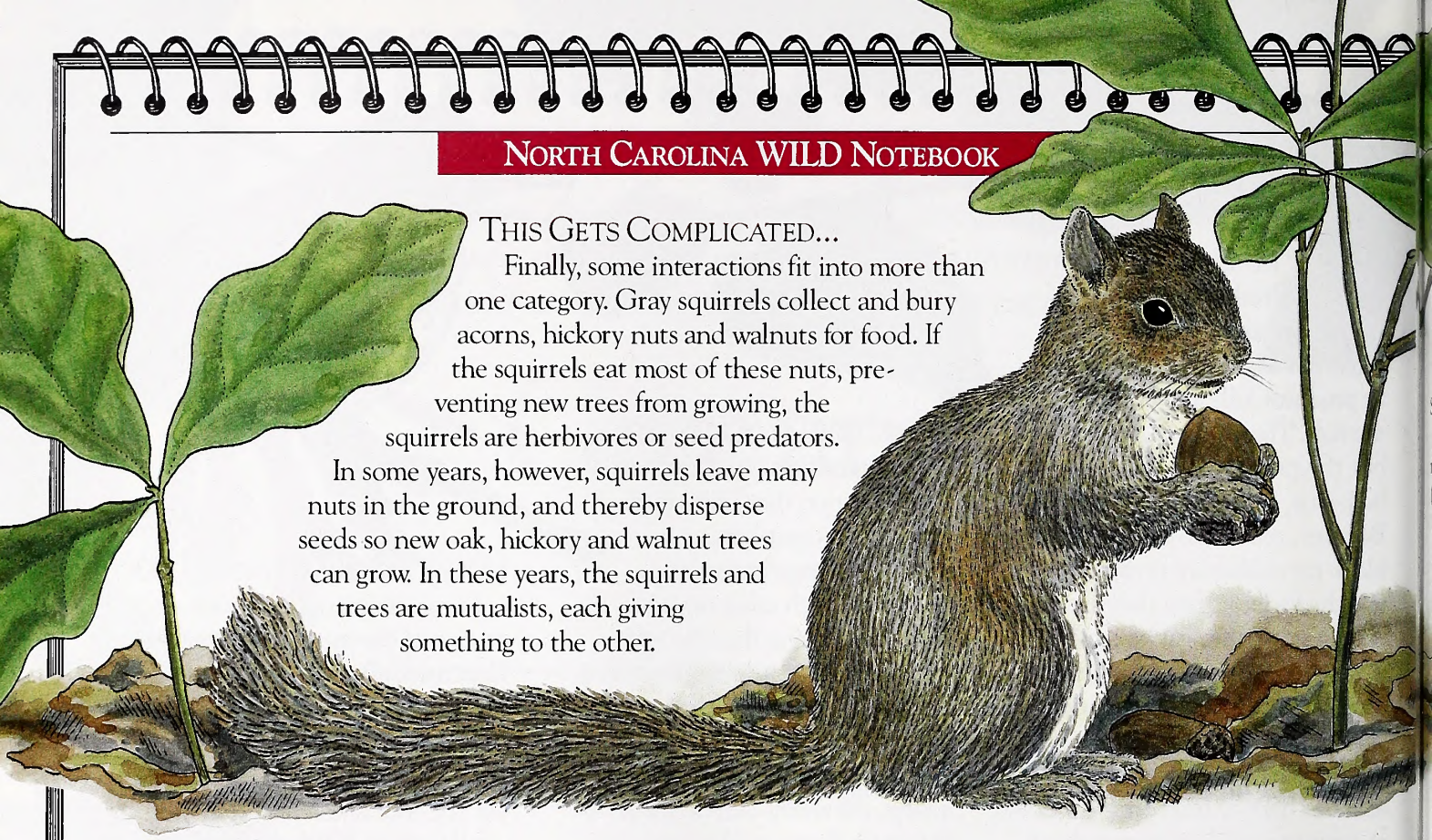
Competition is a common type of interaction that hurts both interacting organisms. When two organisms **compete**, each takes from the other something that the other needs. Every time a red fox eats a cottontail rabbit, the rabbit can no longer be food for a bobcat. Likewise, when a bobcat catches a rabbit, the rabbit can no longer be fox food. Foxes and bobcats compete with each other: both need rabbits for food. But rabbits are too hard to catch and too few in number to provide enough food for all the foxes and bobcats that need them, so some foxes and bobcats die or fail to reproduce.

For two organisms to compete, both must need something that has a limited supply. Two plants growing next to each other on sandy soil compete for the limited nutrients in the soil. Nesting sites for bluebirds are in short supply. When house sparrows nest in a bird house, bluebirds cannot use that nest site, so bluebirds and house sparrows compete. In years when mulberries are scarce, robins and wood thrushes compete for the few berries available. But when mulberry trees produce lots of fruit, robins and wood thrushes do not compete because the bounty of berries can feed everybody.

I Don't Care What You Do

Some interactions have no effect on one of the interacting organisms. **Commensalism** occurs when one organism helps another but is itself unaffected. Spanish moss is supported by the tree on which it grows, but the tree is unaffected by the smaller plant. Wild mammals disperse seeds for burr-producing plants. Carrying burrs causes a mammal little or no trouble but a plant gains by having its seeds carried to new places. **Amensalisms** occur when one organism hurts another but is itself unaffected. Most of these interactions occur between plants. The chemical produced by rotting leaves and nut husks of walnut trees hinders the growth of most herbaceous plants.

Dung beetles roll the feces of large mammals into balls in which they lay their eggs. The larvae eat and grow in the fecal balls and could not live without them.



THIS GETS COMPLICATED...

Finally, some interactions fit into more than one category. Gray squirrels collect and bury acorns, hickory nuts and walnuts for food. If the squirrels eat most of these nuts, preventing new trees from growing, the squirrels are herbivores or seed predators. In some years, however, squirrels leave many nuts in the ground, and thereby disperse seeds so new oak, hickory and walnut trees can grow. In these years, the squirrels and trees are mutualists, each giving something to the other.

What Does It Mean?

amensalism: a relationship between organisms of two different species in which one inhibits or otherwise hurts the other but is itself unaffected

commensalism: a relationship between organisms of two different species in which one obtains food or some other benefit from the other which is unaffected

compete: to vie with another organism for food or other resources that are in short supply

competition: a relationship between organisms of two different species in which members of both species use food or other resources that are in short supply and thereby limit how much members of the other species can get

herbivore: an animal that eats plants

herbivory: the act of eating plants

host: the animal in, on or near which a parasite lives and from which it obtains food or some other resource

mutualism: a relationship between organisms of two different species in which members of each help members of the other species, usually by providing some service or food

mutualist: an animal or plant involved in a mutualism

parasite: an organism that steals food or another resource from members of another species

parasitism: a relationship between organisms of two different species in which members of one species steal food or another resource from members of another species

predation: the act of killing an animal to eat it. Also, the relationship between organisms of two different species in which members of one species kill members of the other species for food

predator: an animal that kills other animals for food

Read and Find Out

- *A Bold Carnivore: An Alphabet of Predators* by Consie Powell, Roberts Rinehart Publishers, 1995.
- *The Clover and the Bee: A Book of Pollination* by Anne Ophelia Dowden, HarperCollins Publishers, 1990.
- *Faith in a Seed: The Dispersion of Seeds* by Henry D. Thoreau, Island Press, 1993.
- *Parasites* by Howard and Margery Facklam, Twenty-First Century Books, 1994.

In *Wildlife in North Carolina*:

- "Natural Buddies" by Lawrence S. Earley, December 1987.
- "Feathered Freeloader" by Lawrence S. Earley, June 1992.
- "Perils of Small Predators" by Lawrence S. Earley, July 1995.
- "Partners for Life" by Lawrence S. Earley, March 1996.

Get Outside

How many examples of various interactions between organisms can you find right in your own yard? Look for relationships between plants and plants, plants and animals, and animals and animals. Don't forget to include insects and other invertebrates when you are thinking about relationships involving animals.

Look at lichens on tree branches, first after a dry spell, and then right after a rain. Can you see the green chlorophyll that is in the alga? It will look even brighter after a rain. Notice also how the lichen is springier and fuller after a rain; that's the fungus swelling as it responds to moisture.

Watch for predation and herbivory right at home. Make a list of every critter you see: squirrels, chipmunks, toads, frogs, lizards, birds and bugs. Can you figure out what they eat?

Get WILD

Advanced WILD Workshops:

April 13-14, 2000 – *Living with Wildlife*, State Forestry Training Center, Crossnore. Contact Anne Hice, (336) 674-6152.

April 21-22, 2000 – *Migratory Songbirds*, Morrow Mountain State Park, Albemarle. Contact Mel Porter, (704) 982-1523.

May 6-7, 2000 – *Migratory Songbirds*, Howell Woods Environmental Learning Center, Four Oaks. Contact Howell Woods, (919) 938-0115.

It's WILD!

Project WILD Activities for teachers and students that correlate to this topic include:

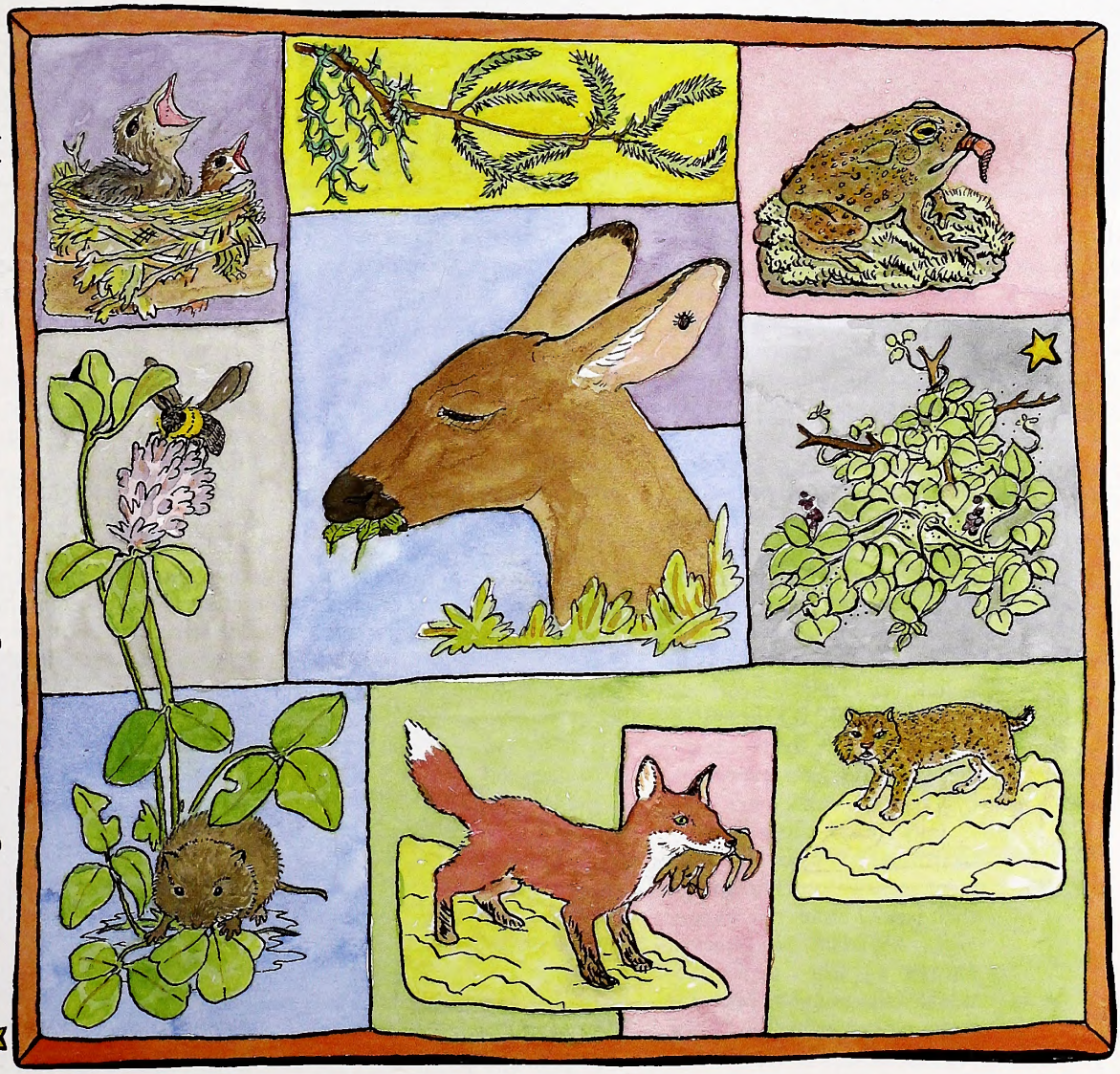
Good Buddies: teaches students to identify and understand commensalism, mutualism and parasitism.

Quick Frozen Critters: teaches students about predator/prey relationships and adaptations of predators and prey.

Urban Nature Search: teaches students to generalize that each environment has characteristic life forms, and to find relationships between organisms in those environments.

Editing and design by Consie Powell. Art puzzle by Anne Marshall Runyon.

A CRAZY QUILT of INTERSPECIES INTERACTIONS



Sun-seeking kudzu vines grow fast and will smother nearby plants.

Can you find all of these interspecies interactions in the quilt?

- Competition
- Mutualism
- Amensalism
- Commensalism
- Parasitism
- Herbivory
- Predation

Wildlife Officers Rescue More Than 1,000 Flood Victims

CHRIS POWELL

***Wildlife Officer** Mark Dutton searches for flood victims in Princeville, following Hurricane Floyd's landfall in September. More than 1,000 people were rescued by wildlife officers during the evacuation.*

Edited by Chris Powell

Using shallow-draft boats and fast-water driving skills, N.C. Wildlife Resources Commission enforcement officers were able to evacuate more than 1,000 people during the September floods resulting from Hurricane Floyd.

On the evening of Sept. 16, wildlife officers from across the state were requested to dispatch immediately to various towns and cities throughout eastern North Carolina. What the officers found once arriving on scene were entire towns under as much as 15 feet of floodwater. About 30,000 homes were affected by the flooding, with many residents trapped by the rapidly rising water.

Initial rescue efforts by municipal and county law enforcement agencies were hindered by their lack of watercraft. However, the Wildlife Enforcement Division was able to deploy 128 wildlife officers and 60 boats just hours after receiving the call for help from the N.C. Division of Emergency Management.

Eric Tolbert, director of the N.C. Division of Emergency Management, said the outcome of the flood evacuations may have been much different had it not for the wildlife officers. "They played a vital role in our search and rescue effort," Tolbert said.

Using highways as staging areas, officers relied on street maps to conduct the nonstop, 72-hour rescue operation, logging a total of 7,877 man hours. Stranded people were plucked from rooftops, second-story windows, attics and treetops. Two-man boat teams worked through several nights, negotiating tricky currents and ducking overhead power lines to make countless trips carrying flood victims to safety.

In Craven County, a Carolina Power & Light Co. crew, trying to restore power, became stranded by high water. National Guard troops attempted a rescue but also became cut off and stranded. State Emergency Management then requested assistance from Wildlife Enforcement officers who responded with a light skiff, saving all 17 people.

Wildlife officers were also crucial in helping to maintain electricity for the city of Greenville. At the flood's crest, water rose to within 2 inches of an electrical line going into the city's main power station. Any contact between the line and the water would have shut the city's power off for days. However, wildlife officers used their boats to form a blockade around the power station, preventing a boat wake or floating debris from touching the line.

It was the same story from Edgecombe to Halifax to Duplin counties, as wildlife officers and their boats played a crucial role assisting local authorities and the state National Guard.

Following the evacuation effort, wildlife officers continued their support by patrolling areas to prevent looting. They also solicited donated pet food to feed stranded pets and helped farmers save livestock that would have become a public health hazard if they had died.

Maj. Ken Everhart, with the Wildlife Enforcement Division, said that there were simply too many acts of bravery to recognize any individual effort. But he added that everyone involved with this operation defined what it means to be a N.C. Wildlife Enforcement officer.

"When asked to stand down after the evacuations were complete, many wildlife enforcement officers requested not to be sent home, despite working long and strenuous hours," Everhart said. "Not one officer asked to be excused from a detail. The actions of these wildlife enforcement officers, in tough times, show how truly dedicated they are to the citizens of this state."

—Chris Powell

Students Contribute to Waterfowling

A Currituck County high school shop class contributed to waterfowl hunting history recently when the students constructed seven duck blinds being used for the first state permit hunts ever in Currituck Sound.

Currituck County, by law, operates under a system whereby a limited number of stationary blinds are available by renewable yearly permits. Over the years, these annual permits have remained with a small number of individuals. However, recently the Currituck County Game Commission opened duck hunting areas to the general public through permit hunts conducted by the N.C. Wildlife Resources Commission.

"In Currituck County, we have a limited amount of water and blinds and we have a tremendous amount of hunting interest because of the growth of the community," said Billy Rose, chairman of the Game Commission. "By opening this federal and state land, it gives us a great deal more hunting opportunity. This also gives these high school students the chance to carry on the Currituck waterfowling tradition, and the Game Commission is proud to be a part of it."

With funding for building materials provided by the Wildlife Commission, the 40 students constructed the seven blinds in September under the tutelage of Jeff Rhodes, a Currituck County High School shop instructor. Each open blind is painted olive green and has four walls, a bench and an outside railing that can be brushed with camouflage.

"I really enjoyed working on the duck blinds," said Kevin Jarvis, a 12th-grade Currituck County High School student. "I, myself, enjoy duck hunting, so I took pleasure in helping the Wildlife Commission."

Wildlife Commission personnel placed five of the blinds on the Currituck National Wildlife Refuge and two on Currituck Banks Game Land. The structures are only accessible by water and will not have camouflaged docking areas for boats. "Hunters will need to pull their boats up into the reeds and camouflage them themselves," said Dale Davis, a Wildlife Commission technician.

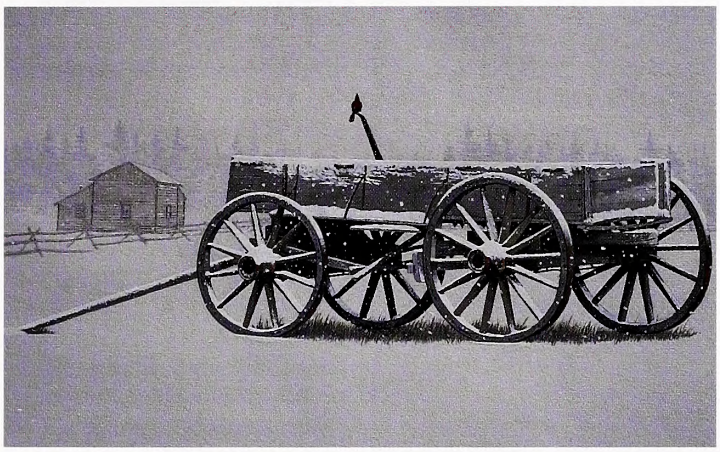
Permits have been issued for the blinds this year, but keep an eye out for opportunities in the *2000-01 Regulations Digest*.

—*Chris Powell*

CHRIS POWELL

***Two Currituck County High School** shop class students help build one of seven blinds the Wildlife Commission recently installed in Currituck Sound for the area's first state permit waterfowl hunts.*

The *2000 North Carolina Wildlife Calendar* Is Here!



"The Snow Cardinal" by Curwood Harrison is one of 12 fine paintings featured in the 2000 North Carolina Wildlife Calendar. *Order now before they're sold out.*

The works of Robert C. Flowers Jr., Robert B. Dance, Dempsey Essick, Duane Raver, David Williams, Brian Edwards, Joe Seme, Tim Larson, Keith Hendrickson and Curwood Harrison are featured in the *2000 North Carolina Wildlife Calendar*.

Order yours today! Payment must accompany your order. Calendar orders may be charged to VISA or MasterCard, or enclose your check or money order (payable to NCWRC). Complete the form below and mail with payment to:

2000 Calendar, N.C. Wildlife Resources Commission
P.O. Box 29607, Raleigh, N.C. 27626-0607
(Office is located at 322 Chapanoke Road in Raleigh.)

GREAT CHRISTMAS GIFT!

Please send me _____ calendars at $6.00 each .....$_____

All N.C. residents add $.36 sales tax per calendar ..... _____

☐ Enclosed is my check for **total** payment of .....$_____

☐ Charge to MasterCard or VISA for the calendar(s) ordered above. My card number is _____ and the expiration date is _____/_____.

_____ (_____)_____
Card holder signature | Day Time Phone No.

If ordering 10 or more calendars, please provide your UPS deliverable address.

Name _____

Address _____

City/State/Zip _____

Phone (_____) _____

All orders must be prepaid. A $20 charge will be made on returned checks (N.C.G.S. 25-3-512). **For fund raising and bulk rate information (10 calendars or more), call 919-662-4377. Please allow 4 weeks for delivery.**

On Patrol

Editor's note: *Listed below is an example of the various situations our North Carolina wildlife enforcement officers encounter while on patrol.*

Last December, wildlife officer Robert Wayne received a call on Christmas Eve to help search for some overdue waterfowl hunters. A Coast Guard helicopter also was dispatched to the area to assist in the search. With the help of a local waterman who knew the location of the hunters' blind, Wayne found a swamped boat along the shore. Fearing the worst, he began searching the shoreline for bodies, debris or anything that would aid in the search. What the officer found was footprints that eventually led to some wet, cold, tired but now safe hunters. When the families waiting for word of the search heard the news, they were ecstatic. (Now that's our kind of Christmas story.)

Wildlife Commission's 2000 Duck Stamp to Be Unveiled

The orginal painting of the 2000 North Carolina Duck Stamp will be revealed for the first time at the East Carolina Wildlife Arts Festival.

The festival and North Carolina Decoy Carving Championship will be held 9 a.m. to 6 p.m. Feb. 5 and 10 a.m. to 4 p.m. Feb. 6 at the Civic Center in Washington, N.C.

Sponsored by the East Carolina Wildfowl Guild, the two-day event will bring together some of the nation's best wildlife artists, carvers and related exhibitors. Highlights of the weekend will include the state decoy carving championships and a wildlife art and decoy auction.

The N.C. Wildlife Resources Commission's duck stamp and print program was initiated in 1983 to raise funds for waterfowl conservation in the state, including acquiring and improving habitat. Money from the sale of state stamps and prints goes into the Wildlife Commission's waterfowl fund, which has raised more than $3 million since it began. The fund has helped in the purchase and improvement of thousands of acres of valuable wetlands, including Conine Island in Bertie County, Hunting Creek Swamp in Davie County and the White Oak Impoundment in Onslow County.

State waterfowl stamps go on sale July 1 for $5 each. (The hunting privilege is automatically included with the annual sportsman, annual comprehensive and lifetime comprehensive licenses.) Prints can be purchased from independent art dealers for $141.

For information about the festival, contact show chairman David Gossett at (252) 946-2897.

—Chris Powell

1999-00 Waterfowl Bag Limits, Shooting Hours and Season Dates for Waterfowl

See the current *North Carolina Inland Fishing, Hunting & Trapping Regulations Digest* for other regulations concerning waterfowl.

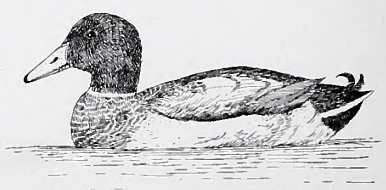
BAG LIMITS

Conventional bag: Six ducks with no more than one black duck (black duck season is closed until Dec. 1), four mallards with no more than two hen mallards, four scoters, three scaup, two wood ducks, two redheads, one fulvous tree duck, one mottled duck, one canvasback or one pintail. The season on harlequin ducks is closed.

Other limits: a) 15 snow geese
b) 2 brant
c) 5 mergansers (one may be a hooded merganser)
d) 7 sea ducks (4 scoters) in special sea duck areas only
e) 15 coots

SHOOTING HOURS

One-half hour before sunrise to sunset



SEASONS

Ducks, Mergansers and Coots: Dec. 8-Jan. 20

Sea Ducks: Through Jan. 20

Brant: Dec. 15-Jan. 20

Swan: Through Jan. 31 (by permit only—5,000 will be issued)

Special Youth Waterfowl Hunt Day: Dec. 4; Youth must be 15 years of age or younger and accompanied by an adult at least 21 years of age. Species include ducks, mergansers and coots. The adult may not hunt these species.

You may also call 1-800-675-0263 for this information.
Report all bands by calling 1-800-327-BAND

Field Notes

Eastern Gun Deer	Through Jan. 1
Central Gun Deer	Through Jan. 1
Western Gun Deer	Through Dec. 11
Northwestern Gun Deer	Through Dec. 11
Black Bear	See *Regulations Digest*
Wild Boar	Dec. 13-Jan. 1
Gray Squirrel	Through Jan. 31
Fox Squirrel	See *Regulations Digest*
Rabbit	Through Feb. 29
Pheasant	Through Feb. 1
Fox	See *Regulations Digest*
Raccoon and Opossum	Through Feb. 29
Common Snipe	Through Feb. 28
Ruffed Grouse	Through Feb. 29
Mourning Doves	Dec. 20-Jan. 15
Woodcock	Through Jan. 15
Crow	See *Regulations Digest*
Bobcat	See *Regulations Digest*

Outdoor Calendar of Events

On several occasions, events in this calendar have been changed without notice. Readers should check with the contact listed before traveling to an event. Items for listing should be conservation oriented and should be sent at least four months in advance.

Dec. 4-5

Do you want to learn more about North Carolina's waterfowling heritage? The 12th annual Core Sound Decoy Festival will be held at Harkers Island Elementary School on Harkers Island. The festival will feature old and new decoy exhibits, carving demonstrations and competitions, educational exhibits as well as coastal food and drinks. For more information, call the Core Sound Waterfowl Museum at (252) 728-1500.

Dec. 4-5

The Swan Days Festival will be held at the Mattamuskeet Lodge on the Lake Mattamuskeet National Wildlife Refuge. The event will feature workshops, historical presentations, arts and crafts, lectures and children's activities. For festival activities, call Margie Brooks at (252) 926-9311.

Dec. 14

The Pisgah Center for Wildlife Education, located near Brevard, will conduct an Eco-Explorers – Wildlife Christmas program 9:30 a.m. to noon. Eco-Explorers is a program series for children ages 7 to 12. Each program focuses on a different eco-investigation that engages children with the natural world. For more information, call (828) 877-4423.

Dec. 15, 16, 17

The Pisgah Center for Wildlife Education, located near Brevard, will conduct the Nature Nuts – Wildlife Christmas program. Nature Nuts is a program series for young children ages 3 to 6 and their parents. Each program focuses on a different wildlife theme and includes stories and activities that engage children with the natural world. For more information call (828) 877-4423.

Catch Us at These Numbers

- **1-800-662-7137** to report violations of hunting and fishing laws.
- **1-800-628-3773** (NC VESSEL) for boat registration and titling.
- **1-800-675-0263** for hunting dates and shooting hours for migratory game birds.
- **1-888-248-6834** (2HUNTFISH) to purchase most licenses and *Wildlife in North Carolina* magazine subscriptions with VISA or MasterCard using a touch-tone telephone.
- **1-800-446-8663** (I GOT ONE) to report big game harvests.
- Connect to the Commission's online web site at **http://www.state.nc.us/Wildlife/**

The N.C. Wildlife Resources Commission maintains five toll-free telephone numbers to provide better services and convenient access to information for North Carolina citizens. Calls are answered in order, but some numbers may require a wait during busy seasons.

VISA MasterCard

Wildlife Endowment Fund Report

Totals Through September 1999

Principal Balance
$28,502,217.75

Interest Earned
$29,204,081.62

Total Receipts
$57,706,299.37

Interest Used
$17,275,819.04

Fund Balance
$40,430,480.33

Established on May 29, 1981, this fund is derived from the sale of lifetime hunting and fishing licenses and lifetime subscriptions to *Wildlife in North Carolina* magazine as well as from tax deductible contributions. While the interest may be used to supplement N.C. Wildlife Resources Commission programs, the principal remains invested to generate additional interest for the future.

Wildlife In North Carolina 1999 Index

Article	Author/Photographer	Topic	Issue
Art/Photo Portfolio			
Down to the Sea in Ships	Robert B. Dance	Maritime scenes	June
Showdown	William Roston	Underwater	July
Autumn Glory!	George Humphries	Fall color	Oct.
A Reverence for Nature	Robert Johnson	Nature preserves	Dec.
Wild Impressions	Ken Taylor	Animal tracks	Dec.
Biennial Issue			
Letter to the Governor	Jim Bennett, Chairman	Biennial Report	Jan.
Progress for Wildlife	Staff	Biennial Report	Jan.
Division of Enforcement	Staff	Biennial Report	Jan.
Division of Wildlife Management	Staff	Biennial Report	Jan.
Division of Inland Fisheries	Staff	Biennial Report	Jan.
Division of Engineering Services	Staff	Biennial Report	Jan.
Division of Conservation Education	Staff	Biennial Report	Jan.
Division of Administrative Services	Staff	Biennial Report	Jan.
Conservation, Environment			
A Green Choice at Tax Time	Rodney Foushee	Saving land	Feb.
Close Call for Kitty	Melissa McGaw	Sea turtle	March
Five Mountains, Five Days	Rodney Foushee	Conservation educ.	March
To Help the Animals	Elizabeth Hunter	Kids Conservancy	June
Celebrating a Conservation Classic	Lawrence S. Earley	Aldo Leopold	Sept.
Fisheries Management			
Good Roads & Good Trout Streams?	Mickey Clemmons	Protecting trout streams	Feb.
Marine Fisheries at a Crossroads	Chris Powell	Div. of Marine Fisheries	March
Fishing for the People	Roger I. Jones	Community Fishing Pro.	June
Braggin' Rights	Rodney Foushee	Angler recognition	July
Fishing, Freshwater			
The Reel That Resurrected Bait Casting	Mike Gaddis	Ambassadeur	Feb.
A Natural Alternative	H. Lea Lawrence	Trout	April
Pond Bass and the Tactical Fisherman	Jim Dean	Bass	May
Edge Logic for Super Bass	Mike Gaddis	Bass	June
Bass on the Hoot Owl Shift	Soc Clay	Bass	July
Fishing, Saltwater			
Fishing the Coastal Inlets	Joel Arrington	Fishing inlets	July
Red Drum, Then and Now	Joel Arrington	Red drum management	Aug.
Surf Fishing Moods	Joel Arrington	Surf fishing	Oct.
Hunting, Big-Game			
Ten Turkey Turnoffs	Gerald A. Almy	Turkey	April
Detective Story	Gerald A. Almy	Deer	Sept.
Dress for Success	Gerald A. Almy	Camouflage	Oct.
When to Hold, When to Fold	Mike Gaddis	Deer	Oct.
Hunting, Small Game and Waterfowl			
North Carolina's Ruffest Gamebird	David Hart	Ruffed grouse	Feb.
Top of Her Game	Mike Gaddis	Bird dogs	May
Doves in the Pickle Patch	Jim Dean	Doves	Sept.
Hunting Season Roundup, 1999-2000	Staff	Hunting seasons	Sept.
The Big Rewards of Small Waters	Gerald A. Almy	Duck hunting	Dec.
Natural History and Wildlife			
The Perilous Good Life of the Box Turtle	Jim Dean	Box turtles	Feb.
Warblers of the Riverbottom Lands	John Trott	Bird watching	April
Not a Whole Lot of High Ground	Bland Simpson	Roan Island	April
Gorgeous Gorges!	Ida Lynch	Jocassee Gorges	May
A Great Place for Salamanders	Harry Ellis	Salamanders	May
Sugar Highs from the Garden	David S. Lee	Hummingbirds	June
Big Trouble!	Tim McLaurin	Diamondback	July
Ecosystem of Castaways	David S. Lee	Sargassum seaweed	Aug.
Our Mountain Medicine Chest	Charles Dickson	Medicinal plants	Aug.
Nature's Little Undertakers	Harry Ellis	Beetles	Aug.
Nature's Ways			
Life in the Basement	Jeff Beane	Moles	Feb.
Tremendous Teeth	Roger A. Powell	Animal teeth	March
Orchids with Attitudes	David S. Lee	Orchids	April
A Nose by Any Other Name	Mary K. Clark	Moles	May
Flower Power	David S. Lee	Flowers	June
Jewels in the Sand	David S. Lee	Insect-eating plants	July
Taming of the Shrew	Roger Powell	Shrews	Aug.
Those Confusing Color Phases	Jeff Beane	Fox squirrels	Sept.
Fish That Build Gravel Nests	Jeff Beane	Fish spawning	Oct.
A Tale of Two Continents	David S. Lee	Shared species	Dec.
N.C. WILD Notebook			
Young Aldo Leopold	Julie Dunlap	Aldo Leopold	Feb.
What Should You Do?	Buffy Silverman	Animal encounters	March
Busy Blue Bees	L. Williams & C. Powell	Blue bees	April
Ghosts of the Past	Ida Phillips Lynch	Extirpated species	May
All-American Alligator	Jeff Beane	American alligator	June
Horseshoe Crabs	Julie Dunlap	Horseshoe crabs	July
Meet Herpetologist Jeff Beane!	Jeff Beane	Herpetologists	Aug.
Speck-tacular Speckles	Terry Krautwurst	Trout	Sept.
Seeds on the Move	Buffy Silverman	Seeds	Oct.
Give and Take	Roger Powell	Interactions	Dec.
North Carolina History			
Shaken by a Living Wind	T. Edward Nickens	Passenger pigeons	Oct.
Core Sound's Historic Hunting Clubs	Rodney Foushee	Core Sound duck clubs	Dec.
Outdoor Recreation			
Winter's Last Gasp	Doug Elliott	Winter hiking	March
One Tough Son of a Flower Picker	T. Edward Nickens	Bartram Trail	Sept.
Our Natural Heritage			
Mr. and Mrs. Lassiter	Jim Dean	Special people	Feb.
How to Jump-Start a Bass	Jim Dean	Bass fishing	March
The Marshmallow Purists	Jim Dean	Fishing	April
Comfort Fish	Jim Dean	Fishing bluegills	May
Classical Bass	Jim Dean	Fishing	June
Joe's Friends	Jim Dean	Fishing buddies	July
The Roanoke Remembered	Jim Dean	Roanoke River	Aug.
Buzzards, Bass and Bull	Jim Dean	Bass fishing	Sept.
Driving Miss Bambi	Jim Dean	Deer	Oct.
Reflecting on Foul Weather	Jim Dean	Bad weather	Dec.
Profiles, Personalities			
The Solitude of the Dunes	Jan DeBlieu	Dunes	July
Ashworth Sundays	Mike Gaddis	William Ashworth	Dec.
Rivers of North Carolina (special issue)			
The Once and Future Little Tennessee	Burt Kornegay	Little Tennessee	Nov.
Refuge of the Cherokee	George Ellison	Hiwassee	Nov.
Falling Waters	John Manuel	Savannah	Nov.
On the Road to Wellville	Bland Simpson	French Broad	Nov.
First in Their Hearts	John Manuel	Broad	Nov.
River of Change	Tim Mead	Catawba	Nov.
Father Yadkin	T. Edward Nickens	Yadkin-PeeDee	Nov.
Blue Ridge Jewel	John Manuel	Watauga	Nov.
New River Rhythm	John Manuel	New	Nov.
Roanoke's Dazzling Diversity	Garnet Bass	Roanoke	Nov.
Patience Pays Off	Shannon & Doll	Chowan	Nov.
River of the Eastern Wildlands	Merrill Lynch	Alligator	Nov.
Treasures of the Upper Tar	John Alderman	Tar-Pamlico	Nov.
The Fight for the River of Peace	Chris Powell	Neuse	Nov.
Historic Gateway to the Atlantic	Philip Gerard	Cape Fear	Nov.
A Glide in the Woods	John Manuel	White Oak	Nov.
River Through Time	Rodney Foushee	Waccamaw	Nov.
Rivers of Life	Staff	River importance	Nov.
From the Mountains to the Sea	Lawrence S. Earley	Introduction	Nov.
North Carolina's River Basins	Staff	Map	Nov.
Kingdoms of the Stream	Derrick Hamrick	Photo essay	Nov.
The Forgotten Streams	Chris Powell	Urban waterways	Nov.
Harnessing Rivers	Rodney Foushee	Dams	Nov.
Friendly Persuasions	Rachel Wharton	River restoration	Nov.
Wildlife Enforcement			
School of Hard Knocks	Rodney Foushee	Wildlife enforcement	April
Wildlife Management			
Big Hopes for Small Game	Chris Powell	Small game	May
A Golden Age for Wildlife?	Carl Betsill	Urban wildlife	Aug.
Wildlife Through The Year			
Building Critter Boxes	Rodney Foushee	Bird/duck boxes	Feb.
Spring Improvements	Rodney Foushee	Spring fieldwork	March
Living with Bears	Rodney Foushee	Nuisance bears	April
Cats and Trout	Rodney Foushee	Cat predation	May
Attracting Hummingbirds	Rodney Foushee	Hummingbirds	June
Problems with Pesticides	Rodney Foushee	Pesticide problems	July
Rabbits and Rye	Rodney Foushee	Rabbits	Aug.
Fall Reminders	Rodney Foushee	Fall fieldwork	Sept.
Backyard Birding Tips	Rodney Foushee	Bird feeding	Oct.

N.C. WILD STORE

Holiday Pop Quiz:

If your "special someone" saw this photo, they would probably think of...

1. Checking to see what day turkey season opens in April.
2. Debating who gets the drumstick.
3. Rising before dawn and dressing in camouflage.
4. All of the above.

Chances are you've got an outdoor enthusiast to shop for. The State Fair, turkey shoots, and giving thanks are reminders that the holiday season is just around the corner.

Consider our great gift items for your special someone. Whether they fish, hunt or simply enjoy the outdoors, we have just what you need to finish your holiday shopping. We've even made it easy for you by selecting some of our most popular items. Just look for this symbol inside:

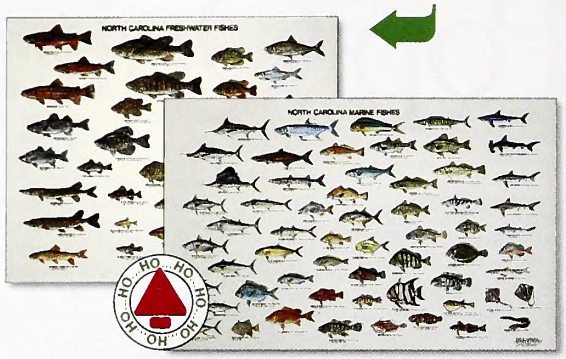
LEONARD LEE RUE, III

See page 40 for our new Wee Tees—T-shirts for kids! ☛

All proceeds from the sale of these products support the development and production of conservation education projects and programs.

N.C. WILD STORE

North Carolina's freshwater fish and marine fish are colorfully displayed on individual posters, and feature the art of Duane Raver. Reel yours in today!



Fishes of North Carolina

Set of 2. Freshwater fish poster shows 36 state species (size 28" x 22½"). Marine fish poster shows 60 species (size 35" x 22½") $10.
ITEM CODE **P9**

Nature's Ways Collection

Explore the wonders of the natural world, wildlife species and ecosystems through "Nature's Ways." More than 200 essays from *Wildlife in North Carolina* have been compiled in a beautiful 6-volume paperback set. $27.50.
ITEM CODE **M9**

Also available as a boxed set. $30.
ITEM CODE **M10**

Before going on your next outdoor hike or camping trip, be sure you know North Carolina's reptiles.

Reptiles of North Carolina

Set of 4 posters in full color. Each poster decribes the species and denotes which reptiles are on the endangered, protected or special concern list. A set includes: lizards, turtles, and both live-bearing snakes and egg-laying snakes. Posters are sized 22" x 34". $18. ITEM CODE **P10**

Amphibians of North Carolina

The Hylid Frogs. North Carolina's tree frogs, cricket frogs and chorus frogs, belonging to the large family *Hylidae*, are presented in this colorful poster, one of two frog posters in the Amphibians series. 22" x 34". $6.
ITEM CODE **P11**

Amphibians of North Carolina

True Frogs and Toads. The second poster in the Amphibians series showcases true frogs and toads. Vibrant photos combine with informative text to make it a standout in the classroom or at home. 22" x 34". $6.
ITEM CODE **P14**

Waterfowl Decoys of N.C.

Nineteen classic waterfowl decoys from North Carolina's legendary days of waterfowl hunting have been collected for the first time on this framable, high-quality poster. This is the first in a series of "Sporting Heritage" posters. 22" x 34". $10.
ITEM CODE **P12**

Traditional Trout Flies of the Southern Appalachians

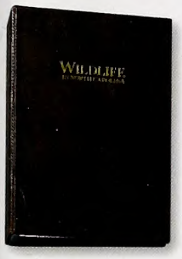
Sixteen traditional trout flies are presented in stunning color detail. Each fly is accompanied by a brief history of its development and use in Appalachian waters as well as the components that make up each hand-tied creation. Second in a series of "Sporting Heritage" posters. 22" x 34". $10. ITEM CODE **P13**

Bird Houses & Feeders: How to Build and Enjoy Them

An eight-page illustrated guide to building bird houses and feeders. $2.
ITEM CODE **M6**

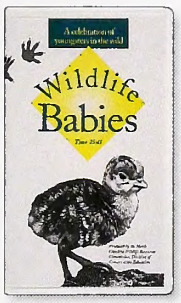
Dogs that Point, Fish that Bite

Here are 50 of the best "Our Natural Heritage" columns written by Jim Dean for *Wildlife in North Carolina* over the past 17 years. Published by the University of North Carolina Press and the N.C. Wildlife Resources Commission. Hardbound. 220 pages. **$19.95.** ITEM CODE **M8**



Magazine Binder

Store 12 issues of *Wildlife in North Carolina* in a sturdy binder. **$10.**
ITEM CODE **M2**



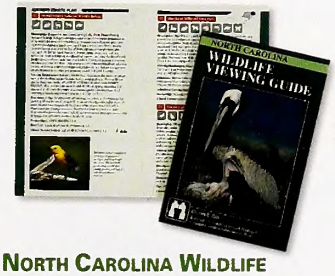
Wildlife Babies Video

Entertaining 25-minute video version of the classic 1965 Jack Dermid film reveals springtime antics of young wood ducks, black bear, possums, cottontails and others . **$20.**
ITEM CODE **N9**

Based on Chief Seattle's 1855 speech, the film's focus is on environmental ethics. Accompanied by This Land Is Sacred, this film is a must-see for everyone. It is destined to become a classic.

All Things Are Connected

Video and Activity Guide. **$22.**
ITEM CODE **W3**



North Carolina Wildlife Viewing Guide

From Cape Hatteras to the Great Smokies, *North Carolina Wildlife Viewing Guide* will lead you to 90 of the state's premier wildlife viewing locations—and better your chances of seeing wildlife once you get there. **$5.95.** ITEM CODE **N6**

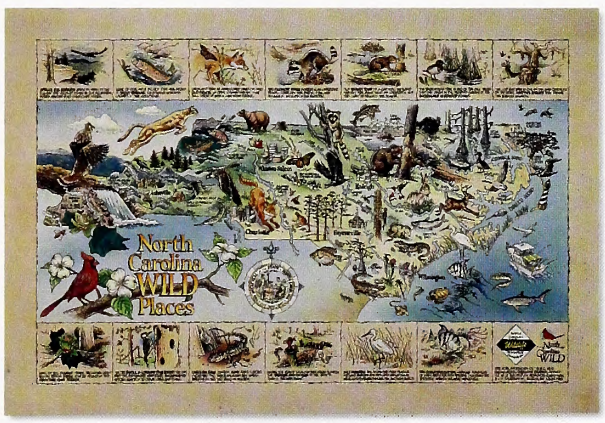
Gardens for Butterflies

Article reprint from *Wildlife in North Carolina* magazine for the gardener who wants to attract some of nature's most colorful creatures. **$2.** ITEM CODE **M5**

Scouting Correlations

Cub, Boy and Girl Scout requirements are correlated to Project WILD and Aquatic WILD activities. Supplements Scout leaders' planning materials and events. Each **$3.**
Cub & Boy Scout Correlation. ITEM CODE **E9**
Girl Scout Correlation. ITEM CODE **E10**

North Carolina's wildlife habitats come alive in this 82-page, easy-to-read, soft cover book. With delightful illustrations by Anne Marshall Runyon, N.C. WILD Places covers 13 habitats across the state.



North Carolina WILD Places: A Closer Look

Book and Posters Set. With each book you'll receive two habitat posters (also by Runyon) and a N.C. WILD Places Map poster, featuring the art of Jackie Pittman. **$16.** ITEM CODE **E6**

North Carolina WILD Places Teacher's Guide

For teachers using *North Carolina WILD Places* in the classroom, these activities and games will heighten student awareness of wildlife habitats. **$6.**
ITEM CODE **E7**

More terrific items ☛

N.C. WILD STORE

Top-quality, 3-ring binder holds 120 WILDlife Profiles. Custom-made binder comes with a table of contents, tab dividers to organize Profiles by classes, an index and 120 fact sheets.

WILDlife Profiles Binder & WILDlife Profiles Sets 1-12

Binder features clear overlay cover, 1 1/2" capacity and inside literature pockets. See the list of species profiled below. $30. ITEM CODE **W17**

Set 1. Black bear, raccoon, white-tailed deer, striped skunk, bobwhite quail, wild boar, muskrat, mourning dove, coyote, mallard.

Set 2. Mink, canvasback duck, red fox, wild turkey, beaver, American river otter, Canada goose, bobcat, red wolf, cougar.

Set 3. Humpback whale, black duck, osprey, clapper rail, red-shouldered hawk, cottonmouth, diamondback terrapin, largemouth bass, black crappie, channel bass.

Set 4. Brook trout, garden spider, Tar spiny mussel, wood duck, bullfrog, mayfly, tiger salamander, bog turtle, hellbender, shortnose sturgeon.

Set 5. Cottontail rabbit, gray squirrel, northern flying squirrel, newt, common crow, red-tailed hawk, prothonotary warbler, bluegill, striped bass, Eastern oyster.

Set 6. Opossum, peregrine falcon, Eastern bluebird, American toad, rat snake, Eastern glass lizard, smallmouth bass, brown trout, monarch butterfly, Virginia big-eared bat.

Set 7. Chipmunk, gray fox, bald eagle, loggerhead shrike, common snapping turtle, five-lined skink, bluefish, rainbow trout, grasshopper, horseshoe crab.

Set 8. Appalachian cottontail, manatee, barred owl, turkey vulture, Neuse River waterdog, spring peeper, coral snake, American alligator, American eel, American shad.

Set 9. Southern flying squirrel, fox squirrel, great horned owl, snowy egret, Southern leopard frog, corn snake, Atlantic sturgeon, walleye, luna moth, crayfish.

Set 10. Marsh rabbit, woodchuck, hooded warbler, whippoorwill, green salamander, copperhead, fence lizard, muskellunge, chain pickerel, Scotch bonnet.

Set 11. Atlantic croaker, Southern flounder, summer flounder, spot, king mackerel, Spanish mackerel, sea mullet, weakfish, spotted seatrout, striped mullet.

Set 12. Bay scallop, black sea bass, blue crab, brown shrimp, spiny dogfish and smooth dogfish, gag, hard clam, menhaden, sandbar shark, white perch.

INVENTORY BLOWOUT! 50% off when you order Sets 1 through 10 inclusive. $10. ITEM CODE **W4-S**. (Does not apply to purchase of individual sets. Offer expires Dec. 31, 1999.)

Embroidered Caps

North Carolina WILD Cap. N.C. Wild cardinal on brushed-cotton twill cap with a Velcro® closure. Two-tone cap is tan/forest green. $16.50. ITEM CODE **A1**

Wildlife in North Carolina Caps. Exclusive designs and magazine logo are featured on three different cap styles. **$16.50 each.**

- Brook trout on sage-colored, brushed cotton cap with an unstructured front, extended bill, and nubuck suede closure. ITEM CODE **A3**
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100% cotton natural color tee with design on back and Pisgah logo on front. $14.50.
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A8MED (medium)
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A8XLG (extra large)
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Just like the adult shirt with Pisgah design, only smaller.
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WINC magazine logo on front pocket. Tundra swan art on back. White. $14.50. ITEM CODES:
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A5XLG (extra large)
A5XXL (extra extra large)

N.C. WILD T-shirt

N.C. WILD logo printed on front and colorful art on back. White. $14.50. ITEM CODES:
A4MED (medium)
A4LRG (large)
A4XLG (extra large)
A4XXL (extra extra large)

MELISSA McGAW

Wishing you a happy holiday season.

from the staff of

WILDLIFE IN NORTH CAROLINA

Deer in Space

After a light dusting of snow, this doe scampers across the whitened landscape, leaving tell-tale tracks to mark her fleeting passage. See story on page 24.

Periodicals postage paid at
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